ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

SEPTEMBER 1958

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FOUNDED 1866

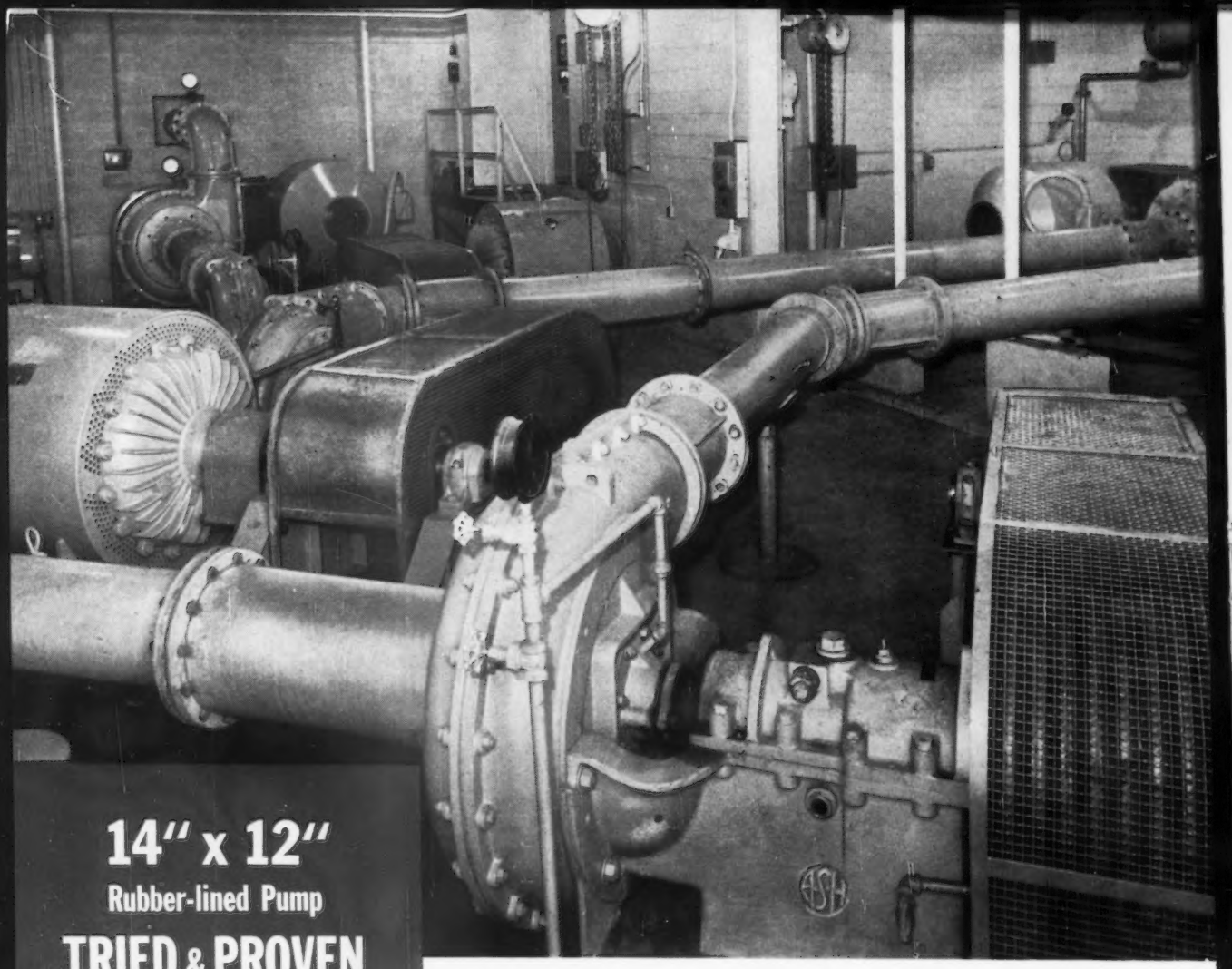
This Month in Mining

Norway — A burgeoning mineral industry is overcoming shortages in engineers, skilled labor, capital and detailed geological information . . . . . p 82

Bolivia — Empresa Minera de Catavi experimented with block caving methods for low grade tin ore, and has now evolved a productive system . . . . . p 86

England — The zinc blast furnace at Avonmouth can now report on recovery and results. More exact study is planned for this most exciting method, piloted by Imperial Smelting Corporation Ltd. . . . . . p 95

United States — Colorado Research Foundation tells how process variables affect solvent extraction of uranium . . . p 102 . . . . . Diamond core drill manufacturers simplify bit nomenclature . . . . . p 100



14" x 12"
Rubber-lined Pump
TRIED & PROVEN
at J & L Plant

Four 14" x 12" Hydroseal D-6-5 split-shell rubber-lined slurry pumps in the tailings booster station. Two in left background work together in series. Two in foreground each pump in series to old-style solid-shell Hydroseals.

For over a year newly-designed Hydroseal D-6-5 split-shell slurry pumps have been operating successfully in metallurgical plants throughout the country. Six of these world's largest replaceable rubber-lined pumps are in the ore-recovery plant of the New York Ore Division, Jones & Laughlin Steel Corp., at Star Lake, N. Y. Pumping right along with over 40 solid-shell Hydroseals, they have more than equalled the efficiency and cost-cutting records of their forerunners.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

ASH

See this pump
at the
MINING SHOW
San Francisco—Sept. 22-25
Booth-1615

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

How three Eastern drillers

PARLAYED 3 DRILLMASTERS INTO 18

with big profits from the I-R DOWNHOLE drill

These three case histories tell a story that is vitally important to anyone engaged in blast hole or water well drilling. If you want to improve your profit picture in a growth business, it will pay you to look into the many exclusive advantages of the I-R Drillmaster and DOWNHOLE drill. Ask your Ingersoll-Rand representative for complete information, or send today for a copy of Bulletin 4179.

Sullivan Trail Coal Co.
West Pittston, Pa.

To speed coal stripping operations at a number of separate mining properties, Sullivan Trail purchased its first I-R Drillmaster on June 7, 1955. This was a TRUCM rig, mounted on a 6-wheel highway truck and equipped with the revolutionary I-R DOWNHOLE drill. The speed with which this unit penetrated the hard and broken rock overlaying the coal strata made an immediate "hit"—and its ability to quickly change over to straight rotary drilling for the shales and less abrasive formations made it even more desirable. The investment proved so profitable that *two more* TRUCM units were purchased on Feb. 3, 1956—and still *another*, on Nov. 2, 1956! This fleet of four rugged and highly mobile units proved the ideal solution to all jobs where frequent over-the-road movements were required. And for the large stripping operations, where one drill could be kept on the job most of the time, *two* crawler-mounted DM-3 Drillmasters were added on Aug. 8, 1957. All *six* of these heavy-duty blast hole drilling rigs are equipped with I-R DOWNHOLE drills and long-lasting Carset Bits—an unbeatable combination for lower cost per foot of hole.

C. S. Garber and Sons
Boyertown, Pa.

This contract driller purchased his first TRUCM Drillmaster unit on Jan. 25, 1955—primarily for blast-hole drilling on quarry jobs where fast moves were required from one quarry to another. Equipped with the I-R DOWNHOLE drill, it set entirely new standards of performance and costs. Then they tried it on a *water well job*—with such phenomenal success that *another* TRUCM unit was ordered on March 23—and *two more* on June 7 of the same year! The profit potential of these machines for water well drilling soon made this a major use of the DOWNHOLE drill, and business boomed to the point that *two additional* TRUCM units were added to the Drillmaster fleet—in April and July of 1957. Today, these six I-R Drillmasters, with I-R DOWNHOLE drills, are meeting all requirements for a greatly increased business in both quarry and water well work—an increased work load for which the machines are largely responsible. The ruggedness and roadability of the TRUCM mounting makes it ideal for contract drilling where you're here one day—and miles away the next.

New Jersey Drilling Co.
Madison, N. J.

Today, this company is one of the largest and most successful contract drillers in the State—operating a fleet of *six* I-R Drillmasters for both quarry and water well work. This "success story" really began only a little over three years ago. On May 25, 1955, to be exact—the date on which they purchased their first DM-2 crawler-mounted Drillmaster with I-R DOWNHOLE drill. Here, too, it was used initially for blast hole work in quarries—then applied to water well drilling. This proved so profitable that *another* DM-2 was purchased on Nov. 9, 1955. And in April, 1956, a TRUCM unit was obtained for use solely as a high-speed, highly mobile water well drilling rig. As business and profits increased, *two more* DM-2s were purchased—in July and August of 1956. And on Sept. 17, 1957, the entirely new TRUCM-3 unit, on I-R's specially designed Crane Carrier vehicle, completed the present Drillmaster fleet. All six units use the I-R DOWNHOLE drill—the ideal setup for hard rock water well drilling. To prove the point, one TRUCM-3 unit drilled 50 wells in granite in 3 months, averaging 100′ per day.

Ingersoll-Rand

S-866 11 Broadway, New York 4, N.Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

SEPTEMBER 1958

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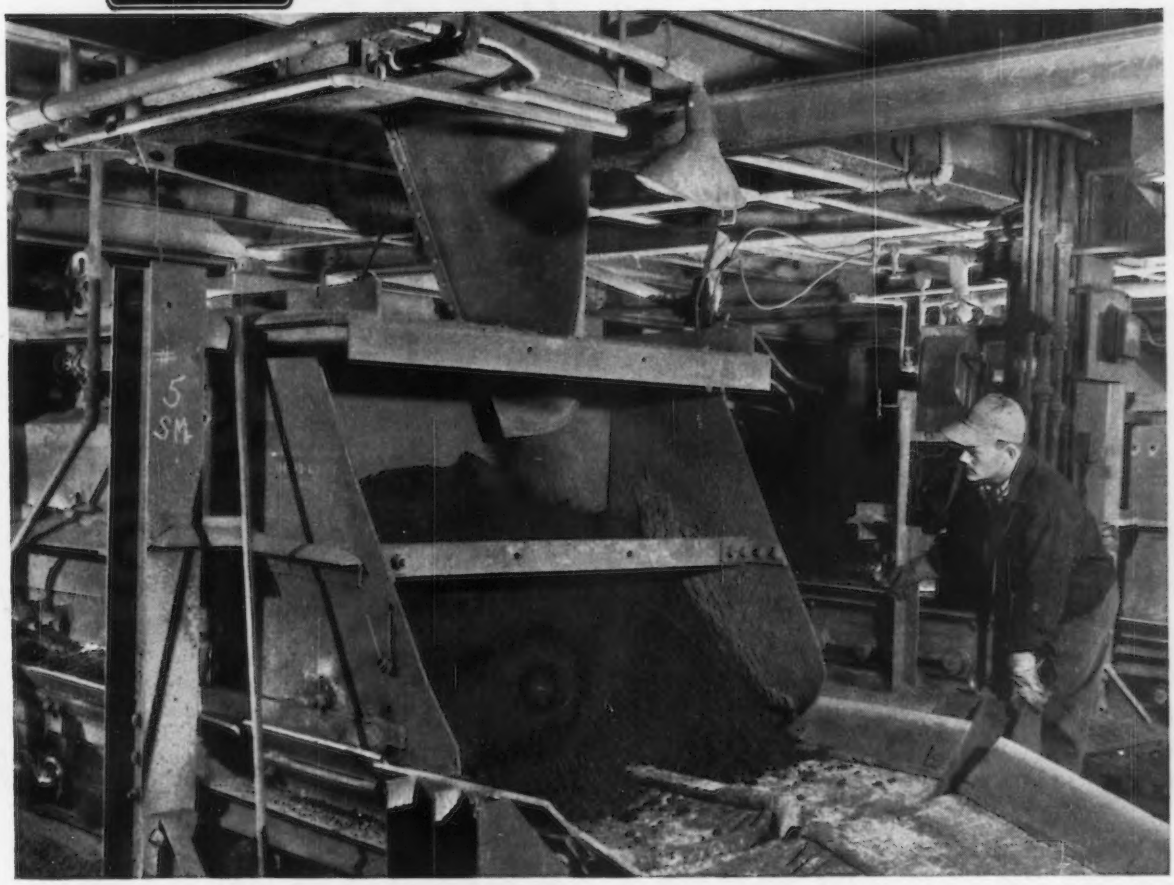
B.F.Goodrich



How rubber chutes save $8000 to $10,000 a year

B. F. Goodrich improvements in rubber brought extra savings

Problem: That black stuff pouring out of the chute was causing plenty of trouble in this zinc plant. It's a highly abrasive sinter mix—wet, hot, and so corrosive it would eat through metal. It was wearing out chutes, made from pieces of conveyor belting, in a few weeks.

What was done: When a B.F.Goodrich distributor heard about the problem, he recommended that the chutes be made with a special kind of B.F.Goodrich rubber sheeting, called Armorite, that's especially compounded to stand terrific abrasion. This rubber is so tough, it's even used in some places to handle broken glass.

Savings: Plant men first estimated that the Armorite would last four to six times as long as the chutes previously used, and save $8,000 to $10,000 a year. Now they say it is lasting about 8 times as long. No more maintenance problems.

Extra benefits: B.F.Goodrich Armorite can be used in dozens of ways—as a liner, curtain, throw mat or pad for protection against abrasives. Can be ordered with or without a reinforcing back of fabric, fibre or steel. It often lasts 10 times longer than steel; eliminating frequent, costly replacements of abrasion-worn metal parts.

Where to buy: Your B.F.Goodrich distributor has full information on Armorite. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-38, Akron 18, O.*

B.F.Goodrich industrial products

Behind the By-Lines...

This issue is designed for those among us who didn't get to do all the traveling that should go with summertime. As the cover indicates, you can do some vicarious ocean spanning just by dipping into this month's book.

Following the latest installment of *E&MJ*'s International Mining Series, this one devoted to the mining potential and major operations of Norway, you can hop south to Empresa Minera de Catavi, situated near Llallagua, Bolivia. Los Bolivianos, before they took a chance on block caving in their own property, studied the method at other properties in Latin America. But even with the example of other operations, the Catavi team found that there was a lot of information which is only gained by experience. How they evolved a block caving system to answer their own specific problems is told in the article which starts on page 86.

Incidentally, if you've been following the discussion of Catavi past and present which has been appearing in the Letters column, there's more on page 99.

We've got another letter, this time from a Miss Jane Bennett, secretary to the advertising manager of Atlas Powder Co., and obviously a very understanding gal.

> Dear Sir:
> On p 91 of the August *E&MJ*, last paragraph, you credit us with an "Armcaster switch for dependable firing of delays." . . . I leaped to my files, because it should be *Arcmaster*. And that's just the sort of typing mistake I cna aesily amke. But it looks like its your typo, not mine. Not that I don't think armcaster might be a good name . . . but we're proud of our own Arcmaster. . . .
>
> Sincerely,

There you are, gents. A perfectly good trade name, free, through the courtesy of the printer and Miss Bennett. Sounds ideal for a loader or a dragline.

You'll get to meet our new friend, Nils Apeland, citizen of Norway, on p 82. Mr. Apeland is a veteran of several years duty on the *Aftenposten*, Oslo's leading newspaper, where he specifically covered the raw materials industry. He's on a visit to the U.S., and kindly offered to contribute to our International Mining Series.

We've tossed in some non-technical information at the end of the article which will interest students of European history.

It seems that the site of Titania's research lab is also the spot where Norway declared its loyalty to the Allies, and settled whatever doubt might have been in the minds of the Nazis. The name of the spot is Jossingfjord, which is pronounced as if the first "o" where "oe." What you wind up with is something like "Yussingfiord," but that's not quite it, either.

Anyhow, for the rest of the war, Norway was epithetically divided between the Quislings and the Jossings, the latter representing the resistance fighters.

Another of our favorites is Mo i Rana, which sounds like Moo ee Rhana (as in Ghana).

We'd like to go into the pronunciation of Bjorkasen, but the upper plate isn't as firm as it should be.

If your armchair passport is still in order, join us at Imperial Smelting Corp. Ltd.'s zinc blast furnace at Avonmouth, England, beginning on p 95.

Smelter men have been watching the Avonmouth process closely since announcements began about the revolutionary technique, and we're happy to bring you the latest progress report.

Our British cousins, not content with the size and scope of the current installations, are planning a larger model and have great hopes for even more exciting results. We'll keep you in touch.

Another passport (of a kind) is the latest effort by the Diamond Core Drill Manufacturers Association. They call it "DCDMA," too, but we're sorry for the girl who has to answer the phone and use the full title each time.

But, to get back to the passport, it's a simplification of nomenclature that will be a general benefit to drillers and manufacturers alike, both in the U.S. and Canada and elsewhere. The story's on p 100.

For years now, we've been told by our more widely-traveled friends that automobile traffic in Paris must be seen to be believed. Exaggeration being as much the right of the traveler as of the fisherman, we'd nod politely and move on to the next conversation.

But now we're convinced. A recent news item notes that the municipal authorities in the City of Light have succeeded in getting one new traffic regulation passed, and that against violent public opposition.

It is no longer permissible, under the new ruling, to make a "U" turn, backing up.

Last stop on the tour, based on a recent visit to the Colorado Research Foundation by *E&MJ*, brings you up to date on the latest in uranium extraction methods, and some new-old attitudes about mineral processing in general.

Ed Crabtree and his associates are a most cordial bunch, and they're all justifiably proud of the growth of the Foundation, which in a very short time has taken a hand in a number of major challenges in all parts of the industry. The solvent extraction story, along with a profile of the Foundation itself, can be found beginning on page 102.

There is a heritage of Yankee sagacity in the following bit of overheard dialogue that pleases us. And, for those who fear the individual is being ground down by the bigness of our commercial existence, there is a strong note of reassurance:

Boss: "Where ya going?"
Slave: "To get a haircut."
Boss: "On company time?"
Slave: "It grew on company time."
Boss: "It didn't all grow on company time!"
Slave: "I'm not having it all cut."

1,000 Cu. Yd. per Hour Performance with 4 Cat Scraper-Tractor Combinations

Bucking weather and terrain, Cat DW20 Tractors with No. 456 Scrapers removed overburden on this uranium mining operation in Wyoming. The contractor used four DW20s to strip an average of 1,000 cu. yd. per hour.

W. N. McMurry, secretary-treasurer and co-owner of Rissler-McMurry of Casper, Wyoming: "I like the stability of the DW20!"

Mining uranium near Riverton, Wyoming, Rissler-McMurry used four Cat DW20s with matching No. 456 Scrapers to strip overburden at the lowest possible cost per cu. yd. This contractor, working for Vitro Minerals Corp., has utilized Caterpillar machines for 16 years. The owners like the stability, economy and power of their fast wheel scraper-tractor combinations for loading and hauling. They also relied on the rugged punch of a Cat D9 Tractor, a maneuverable D8 and a No. 12 Motor Grader to get the job done on schedule.

The DW20s excavated a 350,000 yd. pit—moving an average of 1,000 cu. yd./hr. Average depth of the pit was 66 ft., and material consisted of loosely consolidated sandstone and gravel plus cemented claystone in the pit's bottom. The DW20s handled a 600-ft. 10% ramp at one end of the pit with ease.

Now the new DW20 (Series F) rig is faster than ever and packs even more punch. Powered with a brand-new Caterpillar Engine, HP is increased to 320 (maximum output). At equal rimpulls, speeds are 10% greater. And torque rise is more than doubled compared to previous models. So the big wheel units give faster cycling for high production and wider profit margins. Combined with a Caterpillar LOWBOWL Scraper, the DW20 is the top earth-moving team for pit mining and other tough jobs.

For an on-the-job demonstration, get in touch with your nearby Caterpillar Dealer today. Find out for yourself if wheel tractors and scrapers can do your stripping more profitably than trucks and shovels.

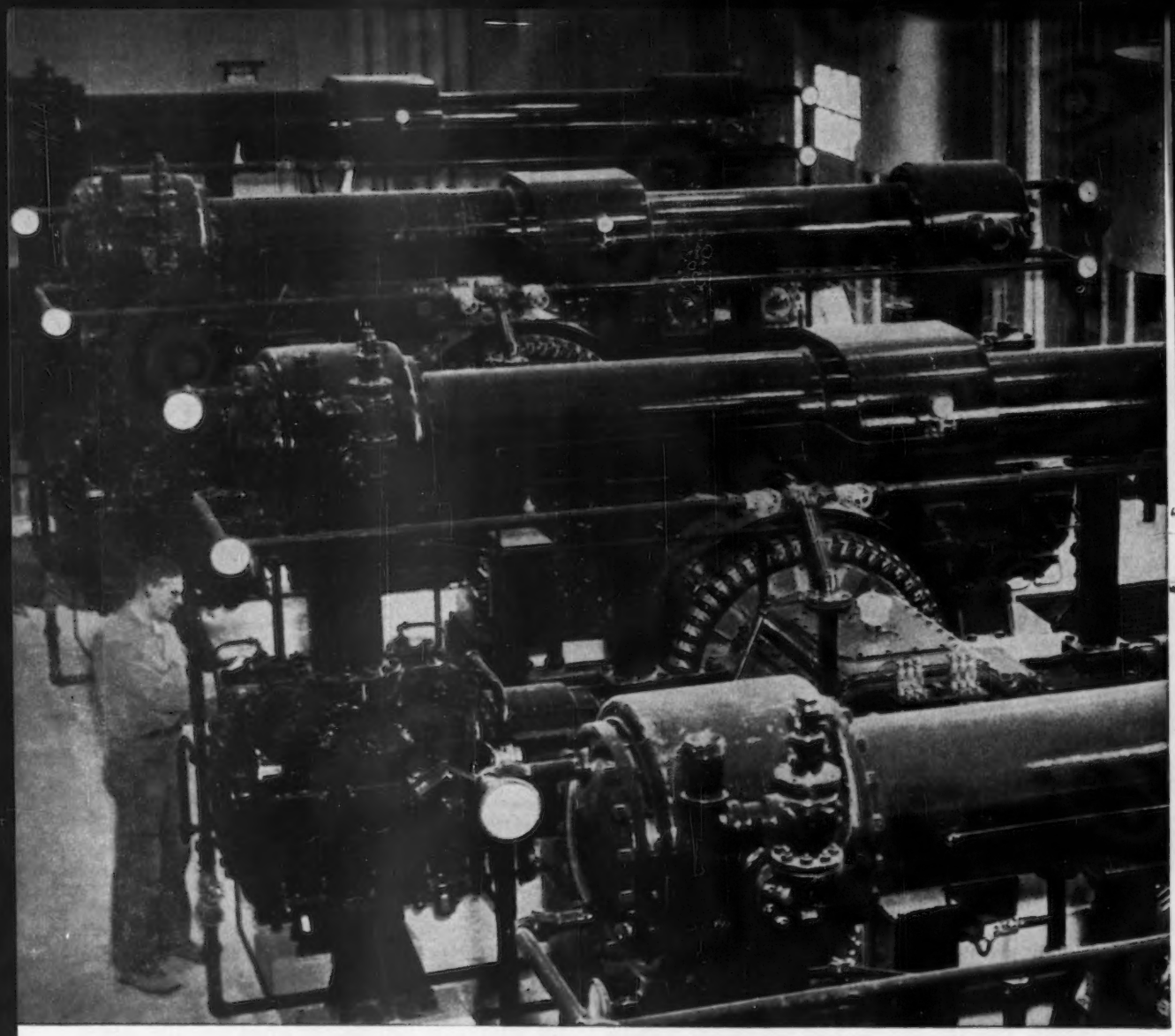
Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

FIND YOUR CATERPILLAR DEALER IN THE YELLOW PAGES

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co

HAUL AT LOWEST COST PER CU. YD.



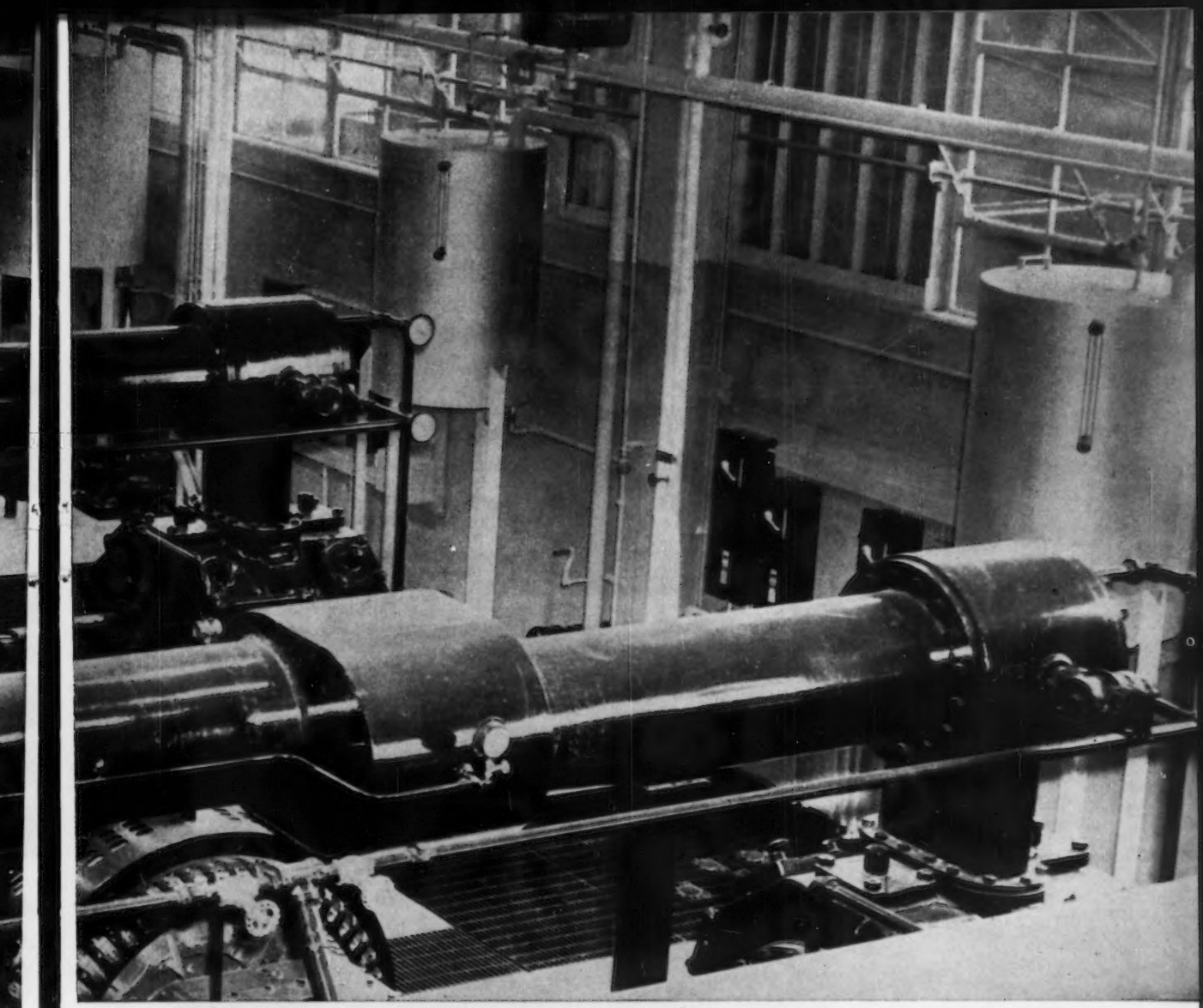
DON'T USE MORE OIL THAN YOU NEED TO

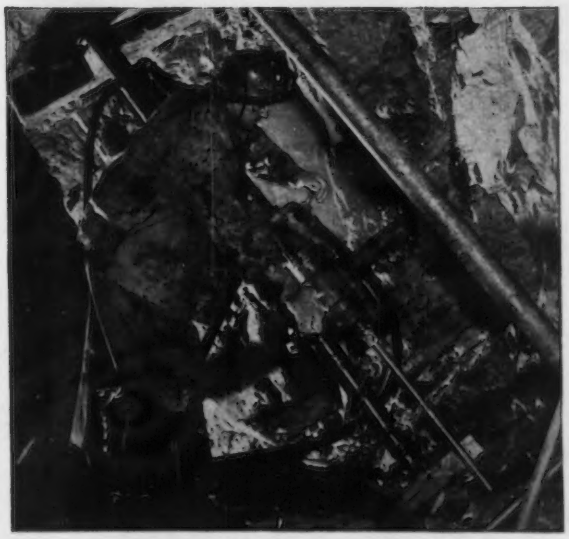
When an air compressor operator sees signs of wear, he often adds more oil and soon finds that over-lubrication is just as damaging. It causes excessive carbonization.

The answer to wear is not more oil but the *right* oil, Texaco Regal Oil R&O. First, it's a superior lubricant, second, its additives protect compressor systems against rust and oxidation, and keep systems clean, free from harmful deposits, assure top performance.

There is a complete line of Texaco Regal Oils R&O—including the right one for your compressors, regardless of type, size, pressure or operating conditions.

Let a Texaco representative show you how Texaco Regal Oil R&O can improve compressor performance. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.





For more than twenty-five years more copper ore in the United States has been mined with Texaco-lubricated equipment than with any other.

TEXACO ROCK DRILL LUBRICANT EP protects your drills against wear when in use, against rust between shifts.

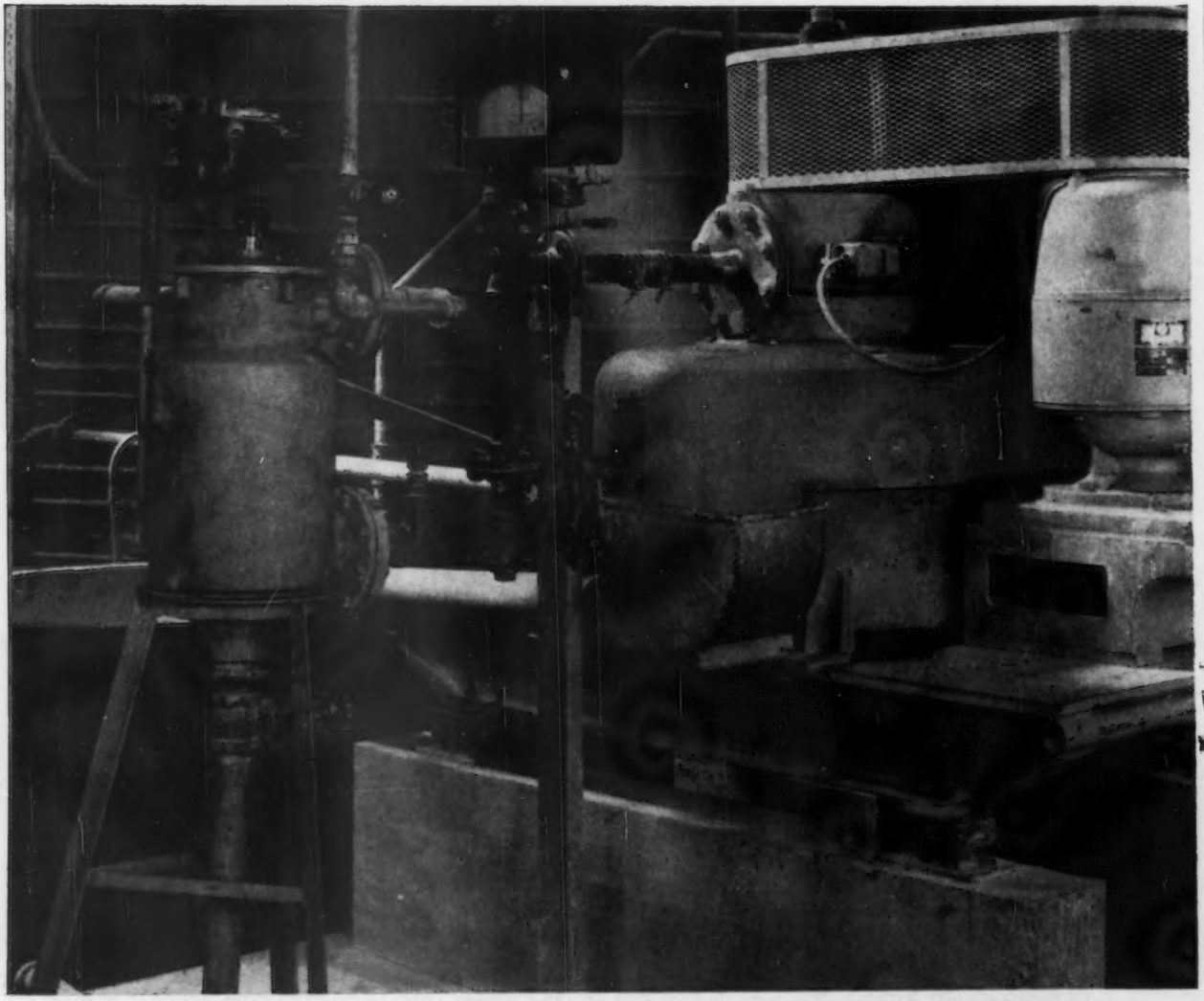
LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Merco Centrifugal Classification of Micron Size Particles

In the production of extra fine grade bentonite clay – a large mid-western chemical company makes skillful use of the effectiveness of Merco Centrifugal Separators in classifying micron size particles.

In this beneficiation process, the clay, after a primary rough cut, is fed to a Merco A-24 Centrifugal Separator for secondary classification.



Final cut is made in a high speed Merco Model C-30 Centrifuge which produces the consistently high quality end product.

The Merco Centrifuge, incorporating the unique return flow principle, can continuously handle the 5 basic separations – concentration, clarification, washing, soluble recovery and classification – on a 24 hour a day, 7 day a week basis.

For more details on the complete line of Merco Strainers, Centrifuges and Screening Centrifuges, just drop a line to Dorr-Oliver Incorporated, Stamford, Connecticut.

Merco – T.M. Reg. U. S. Pat. Off.

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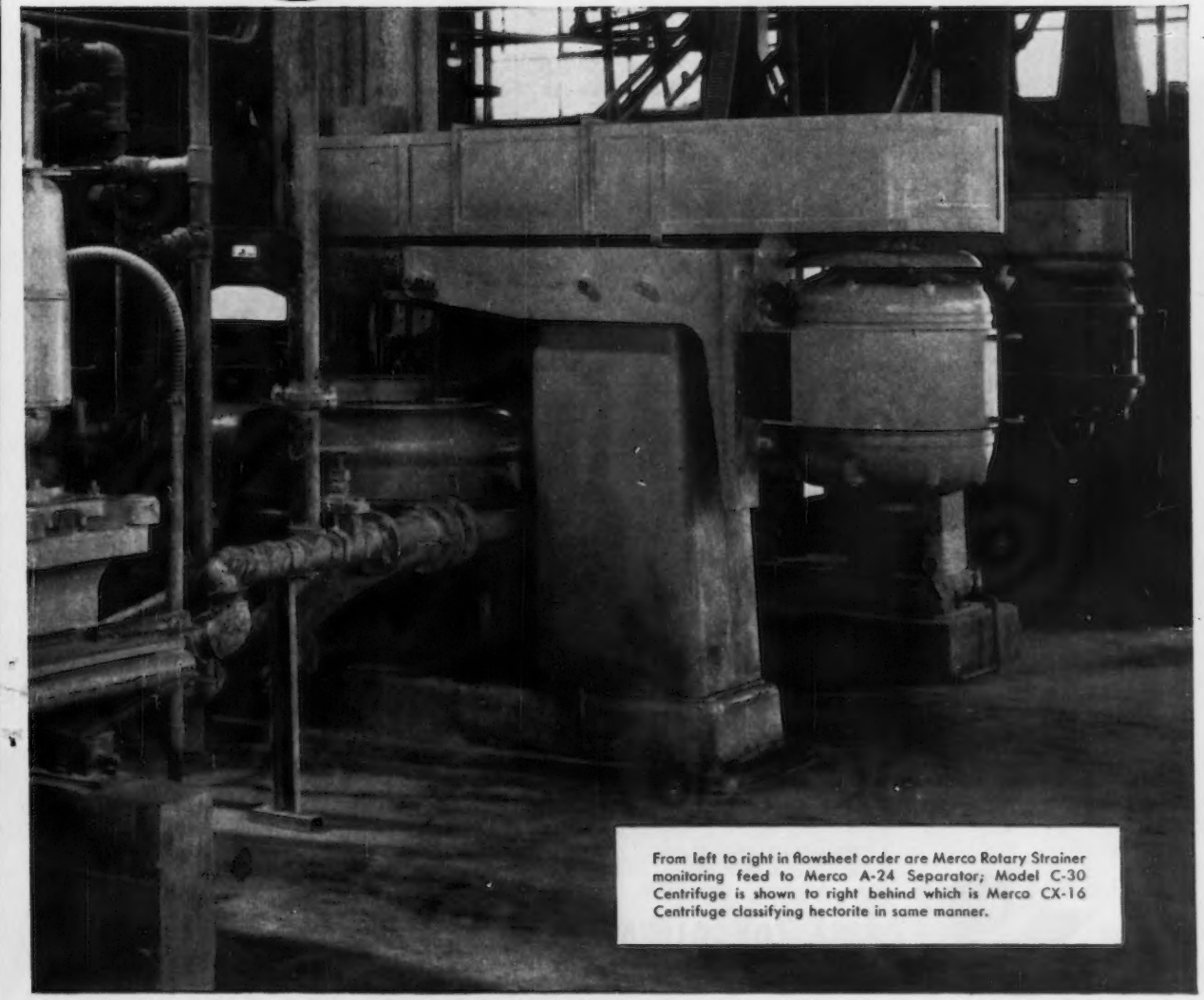
STAMFORD • CONNECTICUT • U. S. A.



From left to right in flowsheet order are Merco Rotary Strainer monitoring feed to Merco A-24 Separator; Model C-30 Centrifuge is shown to right behind which is Merco CX-16 Centrifuge classifying hectorite in same manner.

Whatever Your Mining Operations

from AGGREGATES to ZIRCONIUM

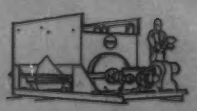
You'll do better with YUBA

50-year leader in mining equipment

Whether your job is to move millions of yards from deep river beds, or to separate rare metallic minerals – up-to-the-minute mining equipment designed, developed, manufactured and *proved* in worldwide application by Yuba will pay for itself over and over again. You'll find it profitable to get full information from *Yuba Mining Division, Yuba Consolidated Industries, Inc., Benicia, California.*

Yuba designs and builds a wide range of equipment for the mining industry, including.

DREDGES-BUCKET LADDER & HYDRAULIC



"MOVALL" EARTHMOVERS

YUBA

YUBA CONSOLIDATED INDUSTRIES, INC.

GOODYEAR TIRES
Look for this nearby Goodyear dealer sign for better tire values — better tire care.
TREAD-WEAR PROBLEMS CHEERFULLY SOLVED
GOODYEAR
HARD ROCK LUG XT

GOODYEAR'S *NEW*

HARD ROCK LUG XTRA TRED

(Tubeless or tube-type, 14:00, 16:00 and 18:00 cross-section sizes)

BUILT SPECIFICALLY FOR MINING AND QUARRYING OPERATIONS!

Like steel, tire cord must be tempered to be tough. Goodyear's exclusive 3-T process, involving Tension, Temperature and Time, triple-tempers cord to make it TRIPLE-TOUGH – to give you longest tire life, lowest cost-per-yard!

The new Hard Rock Lug XTRA TRED is a *specialist*. It has everything the famous Hard Rock Lug family ever had – plus what it takes to keep you rolling on your roughest jobs.

More tread rubber–delivers up to 50% longer tread life. Special, tough-formula rubber holds tread cuts to new LOWS. Bigger, reinforced lugs–burlier shoulders–huskier sidewalls–add new capability, new reliability.

And it's built with Triple-Tough 3-T Nylon Cord – the greatest tire *saver* in 23 years!

The new Hard Rock Lug XTRA TRED wants the toughest tread-wearing jobs you can offer. Visit your Goodyear dealer–and start it rolling up savings!

Goodyear, Truck Tire Dept., Akron 16, Ohio.

Xtra Tred–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR 60th ANNIVERSARY

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Boulder Crusher AR-180

Six of these huge crushers are being supplied for use underground in Swedish iron mines at Kiruna and Malmberget.

The AR-180 with its 71" x 55" feed opening is the largest single-toggle type Jaw Crusher in the world. It can accept blocks of iron ore up to 10 tons and reduce these to 16" thickness. It can be dismantled into component parts suitable for transportation and erection underground.

Built in three sizes

TYPE	FEED OPENING	SETTING	MIN. MINE SHAFT DIMENSIONS	NETT WEIGHT
AR–120	47" × 35"	12"	36" × 73"	81500 lbs
AR–150	59" × 47"	12"	57" × 89"	170000 lbs
AR–180	71" × 55"	16"	60" × 98"	256000 lbs

Single-toggle design — simple and strong.
Frame in sections, with interlocked bolted joints.
Side frames for the AR-180 and AR-150 are of heavy steel plate.
SKF spherical roller bearings — grease lubricated throughout — avoiding oil leakage. Low idling power consumption.

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR • SWEDEN

Moving over 1,000,000 YARDS A YEAR!

HERE at Libby, Montana the Zonolite Co. moves over a million tons of material to produce some 700,000 tons of raw vermiculite.

Three Northwest Shovels working at 4,000 ft. altitude move this mountain of material and, have been doing so for 10 years. The three machines have probably handled over 10,000,000 tons of material.

This output is remarkable when you consider that the shovel operators double as material graders, engaging in a continual sorting operation of selecting the workable ore and discarding the waste, which is cleared away by tractor.

This is just one of the many types of mining operations that Northwests are continually proving themselves on. We built 'em tough then but they are tougher, more versatile, far faster today. That's why one out of every three Northwests sold is a repeat order.

Your Northwest is a *real* Rock Shovel. Check them! Booms rugged and powerful, Sticks of heavy section, the Northwest Dual Independent Crowd—a crowd that gives you crowding force most other independent crowd shovels waste, the Cushion Clutch that eliminates shock overloads before they reach operating machinery, the "Feather-Touch" Clutch Control that assures ease of operation with the true "feel" of the load, Uniform Pressure Swing Clutches that take the jerks and grabs out of swinging and bring greater accuracy to spotting heavy loads.

These are just a few of the features that combine to assure better performance in any digging. They are features that have made the Northwest the recognized leader in rock work.

A big new 80-D 2½ yd. Shovel loading out rock.

NORTHWEST ENGINEERING COMPANY

1509 Field Building • 135 South LaSalle Street • Chicago 3, Illinois

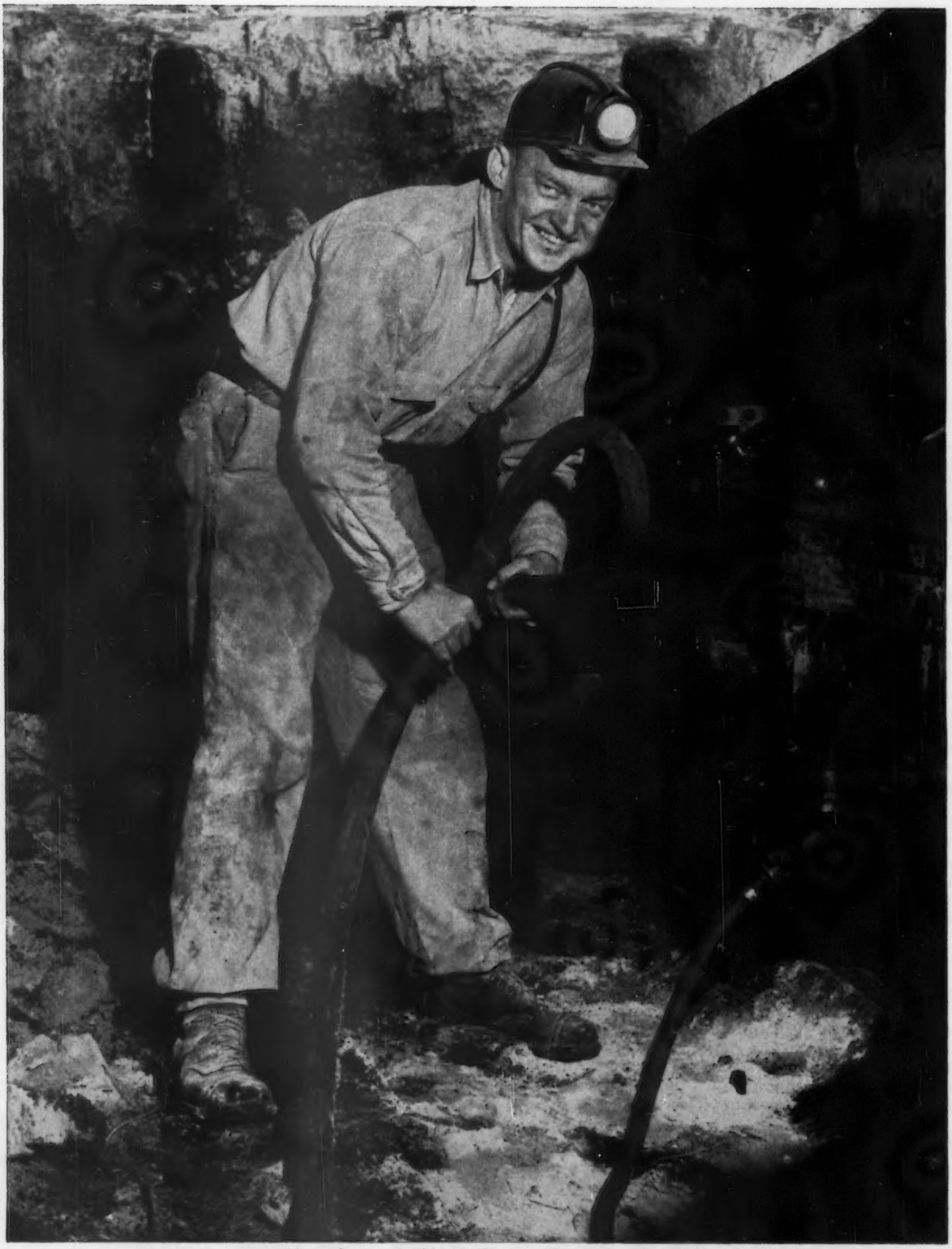
S-80-66-L

NORTHWEST Always Ready to GO

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

If you watch cable costs



11 conductors in this continuous miner cable, yet see how flexible it is.

you'll like Tiger Brand

It's always a thrill to walk into a tough, cost-conscious mine and find that they are using huge quantities of Tiger Brand Amerclad mining cable. It vindicates our attitude that mining cable *must* be built to the very highest standards.

Our flat "Bridgewall" cable is an example. Tiger Brand flat twin mining cable in sizes #1 and smaller actually has a thick wall of neoprene between the insulated conductors. It locks the conductors and ground wire (if specified) in a tight embrace and holds them there—even when the cable is badly bent or twisted. No other type of construction is so durable.

Naturally, flame-resistant jackets are used throughout. And all of these very-heavy-duty cables are vulcanized in a lead mold under pressure, to insure a dense, tough jacket. *Money cannot buy a better cable!*

USS, Tiger Brand and Amerclad are registered trademarks

This special cable was made for continuous miner. It contains power, grounding, lighting and communication conductors.

Rubber-tired buggy fed with "Bridgewall" Tiger Brand. Cable is under *continuous strain.*

Tiger Brand Electrical Wire & Cable

a standard Tiger Brand cable for every special job!

Asbestos Wire & Cable • Mold Cured Portable Cord • Shovel & Dredge Cable • Paper & Lead Cable • Varnished Cambric Cable
Interlocked Armor Cable • Special Purpose Wire & Cable • Aerial, Underground and Submarine Cable

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

Durable answer to you who have asked for a

husky sectional belt conveyor

ANSWERS STORAGE PROBLEM — Using Link-Belt Pre-Bilt belt conveyors to stockpile material 40 feet high, this efficient layout using a radial belt stacker has overcome the restrictions of limited area. System has to operate continuously up to 60 hours, or more.

LINK-BELT Pre-Bilt Belt conveyors handle up to 1500 tons per hour

Per pound of weight, no other sectional belt conveyor tops the strength and rigidity of Link-Belt Pre-Bilt Sectional Belt Conveyors.

For full information on these durable conveyors up to 36 in. wide—with drives up to 40 hp, 24 and 42-inch truss depths or simple channel stringer type — contact your nearby Link-Belt office.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

14,787

From selection to erection . . . you save every step of the way with quality pre-engineered equipment

NO DETAILED DRAWINGS—From standardized data, a Link-Belt engineer will prepare an "on-the-site" quotation covering the components for your needs.

LOWER PURCHASING COSTS—Interchangeability and standardization reduce costs and speed selection of parts . . . all available from Link-Belt.

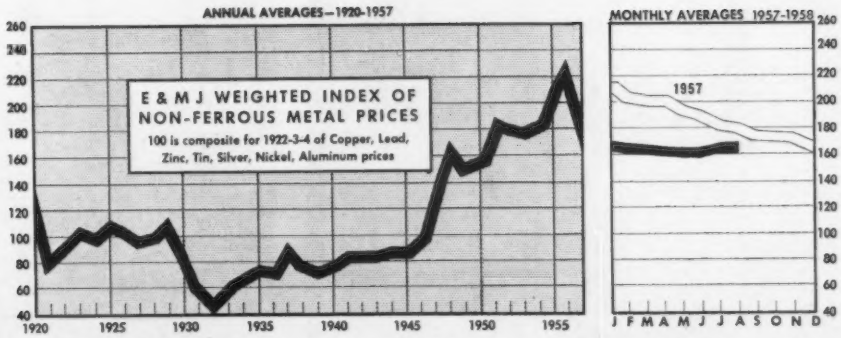
NO COSTLY DELIVERY DELAYS—PRE-BILT conveyors are built at eight strategic locations and are shipped from the plant nearest you to assure prompt delivery.

QUICK LOW-COST INSTALLATION—Simple construction and shop-assembled components facilitate field assembly and installation by your own or Link-Belt erectors.

MINIMUM OPERATING COST—These conveyors require a minimum of power for the tonnages of materials handled. Maintenance normally consists only of lubrication.

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's nonferrous metals price index continued upward, rising from 167.24 for July to 168.36 for August. Higher copper and aluminum prices offset the decline in lead.

●

AT HOME

American Potash Institute is accelerating a campaign urging farmers to use more fertilizer. Institute literature on "balanced fertilizer" shows that farmers could profitably double their present fertilizer usage.

Eagle-Picher's new $2.5-million diatomaceous earth processing plant near Lovelock, Nev., will confine total output to high-quality filter-aid materials.

Business is definitely picking up, but there will be no substantial or sustained rise in sales and profit levels before the turn of the year, according to a National Industrial Conference Board survey of 196 concerns.

U. S. Atomic Energy Commission concludes that it will take a "long time" to produce economic fusion power, if it can be achieved at all.

General Electric Review describes more than 15 unconventional ways to produce electric power, some of which are expected to have commercial application. Methods mentioned include piezoelectric effect, electromagnetic induction, electrostatic generation, thermionic emission, the fuel cell, semiconductor junction batteries, photoelectric units and others.

●

LABOR

Defeat of the Kennedy-Ives bill is expected to improve next year's prospects for legislation to protect the inflation-worried public from growing monopoly powers of labor unions.

International Union of Mine Mill and Smelter Workers is now asking Congress to resort to stockpile purchases with funds available for defense minerals, restrict metal imports from "low-wage areas," and accelerate barter of surplus farm products for foreign metals.

●

ABROAD

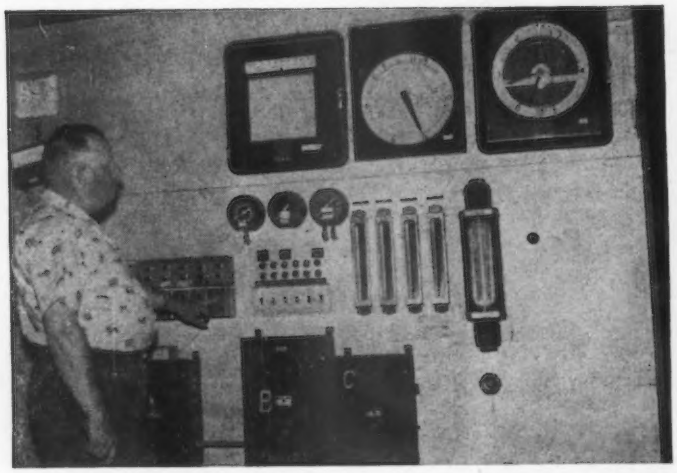
Russia has made impressive advances in the use of iron ore sintering, and oxygen in steel making, but has few large-scale iron ore beneficiation plants, according to observations made by E. L. Joppa, general manager of Pickands Mather's Lake Superior Iron Ore Division.

Henry J. Kaiser Co. will make an engineering report on the Volta River Project for the Ghana Government. Object is to establish a large aluminum industry. British and Canadian companies have also surveyed the area.

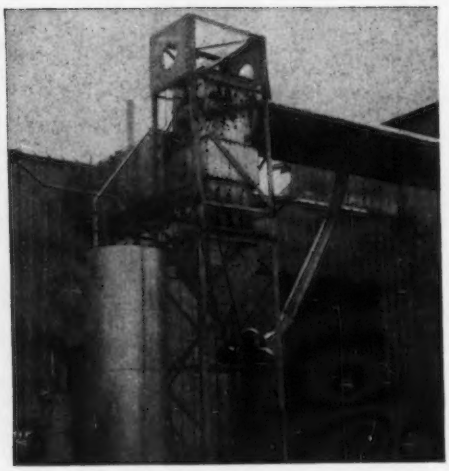
Central Glaze and Ceramic Research Institute, Calcutta, India, has patented a process to use waste mica in insulation materials. At present 90% of the mica from Indian mines goes to waste.

Austrian Foundry Institute has patented a new aluminum alloy containing 10% zinc, 8% silicon, and 0.35% magnesium which has high hardness, tensional and torsional stability. It is produced without any annealing process.

THIS MONTH IN MINING



ONE MAN CONTROL of the entire operation is possible, right up to the storage point. John A. Allen, president and manager, checks the dials.



COOLING WATER TANK feeds the flue water jacket and the multicone aids in fly ash removal.

Northwest Refining Starts ZnO Production

NORTHWEST REFINING AND CHEMICAL CO., Spokane, has begun production at its new plant on Spokane's East Side using a new process for making zinc oxide and ammonium sulphate.

The plant, with a capacity of 24 tpd of zinc oxide and 18 tons per day of ammonium sulphate, also is set up to mix 120 tpd of mineral fertilizers.

The company's process utilizes a specially designed furnace which allows flash oxidization of raw materials and rapid segregation into three principal components—metallic oxides, combustion gases and slag. The gases convey the oxide particles through flues and conditioners to a bag house where the metallic oxide products are collected in marketable form.

Basic steps in the operation are:

1. Flotation concentrates brought in by rail or truck are dried, screened and fed through the furnace by a Syntron feeder.

2. Temperatures in the oil-fired furnace, which run in excess of 2200 F, turn the zinc into zinc oxide and release sulphur dioxide gases.

3. The gases carried by the flue are run through cooling chambers which cut the temperature below 400 F. The zinc oxide is then collected in a bag house and fed by pneumatic conveyor to bins.

4. Anhydrous ammonia with a catalyst is then added to the flue gases utilizing the sulphur dioxide and sulphur trioxide to form ammonium sulphate which also is collected in a bag house.

Officials of the company point out that the remaining slag has only microscopic traces of zinc. Thus the process provides almost a 100% recovery. Northwest's process is unique in that it uses flue gases for producing zinc oxide instead of conventional methods which involve the use of acid.

Officials point out that furnace temperature is a basic factor in the process, since the zinc is oxidized in the furnace by fuming.

It also is possible by the same process to manufacture zinc sulphate instead of zinc oxide, thus eliminating the byproduct manufacture of ammonium sulphate.

The company has shipped more than 200 carloads of materials, most of it fertilizer which is being sold direct to dealers. The zinc oxide is being sold to paint manufacturers. In addition, some powdered zinc has been sold to amateur rocketeers.

John A. Allen, president and general manager of Northwest, said that Northwest production costs on zinc oxide are estimated at some 40% less than conventional methods of producing it. The plant investment is estimated at 80% less. Allen doesn't have a definite cost comparison on production of fertilizers, but he is confident that it is lower. Ammonium sulphate, which is reclaimed as a by-product, is considered a highly profitable part of the operation.

The company uses as a raw material zinc ore concentrates which are purchased in the form of zinc sulphide.

Total plant investment for the company was $392,000. The plant includes a 40x100 furnace building, 60x90 bag house and a 20x40 laboratory. The oil-fired furnace eventually is to be converted to operation by natural gas. The company now uses natural gas for the dryer operation.

The company points out that in the burning operation the fine particles of concentrate are oxidized to zinc oxide and carried out with the furnace gases. The impurities present in the feed remain behind in the slag. Material balances made on the furnace show a recovery of zinc from the bag house product ranging from 96 to 99%. Losses occur in the slag and in the gases leaving the bag house.

The Spokane plant was placed in operation after more than seven years experimentation which included a pilot plant at Wallace, Idaho.

The patented process utilized by Northwest is known as the Wilcox zinc oxide process, developed by Barnard Wilcox, of Spokane. The process has been assigned to Northwest.

Allen said that with a pulverizing mill this process can be used to handle zinc slags which previously were unprofitable to handle. He said it also can be adapted to other nonferrous metals.

The plant currently is producing zinc oxide at a cost of 6⅛c a pound, Allen said, compared with up to 10¾c under conventional methods. He said the product is being marketed at 12½c to 18c, depending on quality. Most of Northwest's output has been marketed at about 14½c.

M. W. Hardy Considers Costa Rican Manganese

ACCORDING to company spokesmen, M. W. Hardy & Co., Inc., New York, has completed an extensive geological survey of manganese ore properties in Guanacaste, Costa Rica under the leadership of Dr. H. R. Cooke, Jr., Reno, Nev. Hardy took an interest in the deposits in 1955 and has since spent large sums of money in road building and exploration.

The first known export of manganese ore from the region occurred during World War I, when Germany allegedly imported 35,000 tons of high-grade ore. The main deposits, however, are determined as low grade, but by a simple

heavy media separation the ore is easily brought up to over 46% Mn. Only undesirable element is silica which in some instances assays 35%. In the past, the deposits have been looked upon by most geologists with skepticism. But tests carried out since then by well known American authorities in this veld have proved the adaptability of the type of ore to heavy media concentration.

The over-all work was carried out by Arnold H. Miller, consulting engineer of New York, and plans are now being considered for the proper development additional expenditures in plant and new of the properties which would require equipment.

Mining Calendar

13th Purdue Industrial Waste Conference & Exhibit. Convention Hall, Philadelphia, Pa., Sept. 15-19.

Rocky Mountain Minerals Conference, AIME, Salt Lake City, Sept. 17-19.

American Mining Congress, San Francisco, Calif., Sept. 22-25

Production Drilling and Blasting Symposium, University of Minnesota, Minneapolis, Minnesota, October 2-4.

Metallurgy '58—Norwegian Industries Development Assn., Oslo, Oct. 15-26

7th National Clay Conference, U.S. National Museum, Washington, D.C., Oct. 20-23

Mid-American Minerals Conference, Society of Mining Engineers, AIME, Chase-Park Plaza Hotels, St. Louis, Oct. 23-25.

Metallurgical Society of AIME, Fall Meeting, Detroit, Mich., Oct. 27-30

International Mining Days, New Mexico Mining Assn. and Southwest International Mining Assn., Carlsbad, N.M., Oct. 30-Nov. 1

4th Annual Symposium on Mining Research, Missouri School of Mines, Nov. 13-14

AIME annual meeting, San Francisco, Hotel St. Francis, Sheraton Palace, Sir Francis Drake. Feb. 15-19, 1959

International Symposium, Physical Chemistry of Extractive Metallurgy, Pittsburgh, April 27

France Increases Iron Production and Stocks

FRENCH iron-ore production rose to 30.6-million tons in the first half of 1958, compared to 28.8-tons in the same period last year.

Total deliveries rose to 28.5-million tons, against 27.9-million in the first half of 1957. Exports totaled 7.6-million tons against 7-million in the first half of 1957, of which 6.7-million tons went to Belgium and Luxembourg, against 6.1-million last year.

At the end of June, stocks amounted to 4-million tons, against 2.9-million in June, 1957.

(*Continued on p 128*)

As We Went to Press . . .

An expanded barter program is in the works at Agricultural Department, but officials are not quite certain how much paper work will be needed for brokers to get minerals-for-crops swaps approved.

Congress extended the basic domestic farm surplus disposal law —PL 480—for a year and a half to the end of 1959, and authorized a new ceiling of $2.25-billion on the value of bartered crops. Also, the new law directs rather than authorizes Agriculture to barter as much as "practicable" up to the $500-million limit. It removes restrictions on accepting domestically-processed foreign ores in barter.

But the new law left a key question open for interpretation. It states that there shall be "no restrictions" on barter procedure, such as the earlier Department regulations which virtually brought barter negotiations to a standstill in recent months by requiring brokers to show by of "certificates of additionality" that their deals were not replacing normal commercial sales of U.S. crops in overseas markets.

But even the new "no restrictions" language is qualified in the current statement by the addition of the phrase "except to the extent necessary to safeguard usual markets," so the Department still has some leeway in continuing its burden of proof of "additionality" on the brokers.

Agriculture officials say they are studying the legal question, but think the new law will not return barter deals to the status they enjoyed before the restrictive regulations, even though they will be made somewhat easier.

Washington is reshaping its whole approach to foreign aid. Note Administration backing for regional development programs—world wide, and specifically in the Near East and Latin America. The trend is toward longer-term loans at lower interest rates, repayable in some cases in local currency. By backing a beefed-up expansion program for the International Monetary Fund and World Bank, the U.S. is also hoping to get more international backing—both governmental and private—for its development financing. Unquestionably, foreign mining will benefit from the new approach.

Uranium Reduction Co., Moab, Utah, has made the first sale of concentrates to private sources for conversion to nuclear reactor feed materials.

URC made the sale to Davison Chemical Co., Erwin, Tenn., a division of W. R. Grace & Co. under a recent easing of regulations involving disposal of concentrates by the AEC. Purpose of the plan is to advance the use of energy on a free enterprise basis.

Western Nuclear, Jeffrey City, Wyo., has been notified by the AEC that their milling capacity must be reduced to the original 440-tpd contract amount on Oct. 1. See page 128.

Minerals Refining Co. is reported to have developed a low-grade fluorspar ore leaching process at their Murray, Utah laboratory which yields a fluoride containing only 0.005% SiO_2. Company is designing a 500-tpd (ore feed) hydrofluoric acid plant based on the process developed by Paul B. Cardon, president.

WASHINGTON IMPACT

Highlights

WHAT NOW—This is the question uppermost in discussions of Government mining policy in Washington this month. As the shock of House action in killing the joint industry-Administration domestic minerals support bill began to wear off, these alternatives faced final decisions soon:

• International commodity controls. Various means of multi-lateral solutions to similiar problems of over-supply and falling prices are getting a thorough going-over at United Nations Commodity Commission talks in London this month (Sept. 8-13). Because of Congress' refusal to pass the Seaton program, plus the effects of the re-instated 1.7c import duty on copper, the U.S. delegation is under vastly greater pressure both at home and abroad to lay the groundwork for some sort of international solutions for copper, lead and zinc. Best bet is an agreement on at least the principle of export quotas, possibly on production controls as well. But direct action will take time.

The U.S. delegation, including Senate Interior staffer Robert Redwine, will have one gambit going for it. It can make clear that the Administration has no choice but to consider higher tariffs, particularly on lead-zinc, unless other nations agree to some controls.

• Higher U.S. tariffs. Duty boosts on lead and zinc can't be ruled out, despite the Administration's opposition to them. The Tariff Commission's unanimous recommendation for higher tariffs still hangs fire, and probably will continue to until after the London meetings. Then President Eisenhower may ask the Commission to take another look. Much higher duty boosts are possible under new reciprocal trade law.

• Another try for legislation. Sen. James Murray (D-Mont.) already is preparing new Government mining industry support legislation for introduction as soon as the 86th Congress convenes next January. But again, the exact form it will take depends on what results from London.

One other possibility, although considered a very slim one, is that the Office of Defense and Civilian Mobilization, under its existing powers through the Defense Production Act, conceivably could step in with a limited stockpile or incentive purchase program.

A still further possibility under discussion is using either an expanded barter program or new foreign aid programs (see p 20) to compensate competing minerals-producing nations for tariff boosts.

IN HAND—The 85th Congress fell far short of most mining industry hopes for Government help. It refused the Seaton program, rejected high-tariff protection per se, never got around to the matter of incentive production bonuses, and Eisenhower vetoed an extension of an old tungsten-fluorspar purchase program.

Nevertheless, industry weight in Congress was felt. New money was voted for exploration and development aid—both in the extension of the DMEA and in appropriations bills for the Bureau of Mines, which since has announced expanded research and technical development projects in nearly every domestically produced metal and mineral. And the reciprocal trade bill gives producers a much better shot at tariff protection.

POST MORTEM—The House death blow to the minerals stabilization bill came as a shock—not so much because it was voted down; that was always considered a possibility in a close vote. But the wholesale slicing up of the measure showed that behind-the-scenes gentlemen's agreements broke down.

First, tungsten and flourspar subsidies were striken. Then the bill was subjected to a $450-million money limit. The final blow came when Rep. Flynt (D-Ga.) won approval for his amendment which would have denied subsidy payment to any mining firm which declared a stock dividend in the preceding fiscal quarter. By then, as one veteran observer put it "school was out," and even friends of the bill deserted it.

The vote cut across party lines, but Democrats supported it almost two-to-one while Republicans voted solidly against it. That showed the Administration either failed to deliver the votes it thought it had, or failed to apply enough pressure.

Senators, led by Murray of Montana, made one last-minute effort to have the bill approved for one year only. It failed.

Trade Act Extension Alters Tariff Climate

THERE ARE important new avenues to trade protection in the Reciprocal Trade Agreements Act extended for another four years by Congress last month. Of particular interest to domestic metal-mineral producers are the new sections dealing with Tariff Commission escape clause actions, Office of Defense and Civilian Mobilization Defense essentially studies, and the new anti-dumping law passed at the same time as the trade bill.

A close look at the new trade program further shows that:

• No tariff cuts are in sight for four years.

• Tariff boosts, particularly in the metal-mineral field, stand a better chance now than before the law was extended.

• There won't be any major shifts in U.S. trade patterns—exports or imports, until after the European common market gets going in 1962.

• After that, there will be an increasing emphasis on selected or marginal markets and product categories.

The reason no tariff cuts will even be negotiated until late 1962 or early 1963 is because it will take the infant European common market, under its present timetable, that long to even begin moving toward a common external tariff schedule for its six member-nations.

Until that point is reached, neither the U.S. nor any other trading partner can sign new bilaterial or multilateral trade pacts with Western Europe.

Existing trade agreements, of course, can still be changed. But rates are not likely to be dropped until the common market members are further along in setting internal rates between themselves, and that won't be for at least two years.

Also, because adjustments made under the General Agreement on Tariffs and Trade (GATT) must apply equally to all 37 member-nations—as provided by the most-favored-nation clause—the U.S. and other traders such as Japan will be virtually blocked from drastically altering their rates with other nations, including the metal-mineral producing states in Latin America, Asia and Africa.

Meanwhile, the doors to administrative protection in the U.S. have been opened wider by the new trade law, and other new changes in the separate anti-dumping act.

Escape clause petitions at Tariff Commission will increase. They are now easier to file. So will pleas for tariff relief on the grounds of defense essentially before the Office of Defense and Civilian Mobilization (ODM is now ODCM) under its new national security language, which requires the agency to take almost all domestic economic factors into consideration in determining a producer's defense role.

The new anti-dumping law makes it easier for domestic competitors to win

punitive duty boosts on low-priced foreign imports. One aluminum fabricator has already filed for relief. To show injury under the law, a domestic producer now needs only to convince three members of the Tariff Commission—the law interprets a three-three split as a finding of injury. And once injury has been shown the Treasury now has wider leeway in assessing higher duties and in comparing U.S. and foreign prices and comparable items.

Further, the President may raise tariffs under the new law by as much as 50% over the older, higher 1934 rates, instead of basing boosts on the 1945 schedules.

Finally, Congress, by a two-thirds vote, may override the President's rejection of a Traiff Commission recommendation for escape clause duty hikes.

These loopholes are, of course, permissive, not mandatory. How much they are brought into new play depends on the Administration handling them. But the opportunity for domestic protection has been increased. And because most of the fat already has been cut out of U.S. tariff schedules, any further cuts—which the Administration hopes to sign in 1962—will be fought even harder.

On the other hand, liberal traders see the 11th Congressional extension of the basic trade law as an important psychological symbol. It reassures foreign traders that Washington intends to stand by a relatively liberal trade policy.

Because of the common market's virtual freeze on new tariff negotiations, trade patterns are expected to remain fairly steady. Recent drops in both U.S. exports and imports will probably be reversed, assuming reasonably stable general economic factors here and overseas—which experts feel have more to do with trade flow than tariffs and other trade restrictions by themselves.

This means nonferrous ores and metals will continue to lead U.S. imports. They totaled nearly $2-billion in 1957, will drop about 15% this year, but slowly pick up again.

Raw and producers' materials, on the other hand, will remain tops among U.S. exports. Big machinery markets overseas should expand. But as Europe and the underdeveloped areas raise their productivity levels, U.S. exports will find themselves concentrating more on specialized items—automation equipment, atomic-age equipment, and the like. Also, U.S. shipments of machinery made here will be slowed by the trend on the part of many domestic manufacturers to set up overseas plants to better compete with the European market.

•

An expanded barter program is one of the expected results of the Government's activity to aid minerals. See page 19 for the most recent developments.

Labor This Month

RACKET PROBE STIRS NEW CRACKDOWN: The revelations of Teamster racketing in the late rounds of the McClellan Senate committee hearings is forcing new clean-up moves. The AFL-CIO, which kicked out the Teamsters last year after the first set of McClellan hearings, is going the next step. Federation president George Meany wants all AFL-CIO union pacts with the Teamsters union cancelled. This means some dozen agreements covering such unions as the machinists, the office employees, three building trades unions and others. These are joint organizing and mutual aid working agreements.

When the McClellan committee turned out new evidence of Teamster corruption under James R. Hoffa's leadership, Meany demanded all such pacts at the top union level be erased. He says they give aid and comfort to the Teamsters; a violation of the Federation's constitution. But, while this severs pacts at the top, it won't affect the cooperative operations between the Teamsters and the other unions in the field. Where the Teamsters have been working before with AFL-CIO affiliates at the loading platform or in the plant—or anywhere the truckers meet the producers—the arrangements will continue as before. So, don't look for a jurisdictional war just because of the top-level split. None of the unions want that.

THE LABOR RACKET PICTURE: The details of union corruption developed in the Congressional probe of Teamster president Hoffa disclose mishandling of union funds and mis-management in office. Whether they show anything more definite than this about the Teamster leader is unsettled. This is some of the record:

• A Teamster strike threat to Detroit laundry owners is ended with a $17,500 payoff to a labor relations firm of Holtzman and Bushkin. After the payoff, Hoffa enters the negotiations and the dispute is settled.

Hoffa denies taking any payoff; the employees suspect maybe he did but don't really know. Hoffa does testify, however, that he borrowed $5000 apiece from Holtzman and Bushkin and says he paid it back in cash. There are no records. Holtzman is deceased and Bushkin takes the fifth amendment.

• Hoffa's closest friend is Owen Bert Brennan, number two Detroit Teamster. In joint programs, Brennan handles Hoffa's race track bets. They owned a heavyweight fighter together and Brennan put him on the Teamster welfare fund payroll at $75 a week. The fighter did no fund work. At the hearings Hoffa was asked about his income tax claim of $60-thousand in winnings since 1946. Also about the fighter. Hoffa says Brennan handled all this. Brennan declined to testify with the fifth amendment.

• The Hoffa-run Central States Welfare Fund loans $1.2-million to a department store owner, whose firm later goes bankrupt. Hoffa testifies to be a friend of the owner, that he received expensive gifts from him. Asked about a mink stole, Hoffa says he paid $500 to the businessman for it. There are no records; Hoffa says he deals only cash. There is no counter testimony. These are just a few examples of the evidence dug up by the McClellan committee.

AFL-CIO SCRAPS OVER METAL JOBS: Trouble is brewing in the House of Labor between the United Steelworkers and the Federation's Metal Trades Department. They're rivals over job jurisdiction—this time in aluminum plants—and the scrap has broken out into words. The industrial union department, backing a complaint by the steel union, is protesting job invasions by the metal working unions. Standing on the sidelines this time is the Mine-Mill and Smelter Workers union which is temporarily free of such rivalry.

The United Steelworkers, who have lost most jurisdiction battles with Mine-Mill over nonferrous jobs, are now being taken on by other AFL-CIO unions. The shoe is on the other foot—and Mine-Mill can sit by and watch for a change. The Steelworkers charge that the metal trades unions are trying to organize in their territory via "repeated and continuous violations" of the AFL-CIO constitution.

MARKETS

Congress Rejects Subsidy Bill; Smelters Drop Copper Price to 26c

Nonferrous metal prices as measured by the *E&MJ* index rose to 168.36% of the 1922-24 average in August from 167.24 in July. The increase in copper and a slight rise in the monthly average price of aluminum brought the index up. The drop in the lead price had little effect on the index.

Subsidization of U.S. mining firms was turned down by the U.S. House of Representatives Aug. 21. It voted the bill down by 182 to 159. The drive for aid to the mineral industries will continue. President Eisenhower last year had indicated he believed import duties on lead and zinc should be increased. Clarification of the effects of such a move, especially on U.S. international relations and on its export trade, led to the attempt to provide other means to aid U.S. nonferrous mining firms. Failure to approve the subsidy measure has led to some expectation (hope, by many U.S. mining companies) that the President would raise tariffs. He indicated earlier in the year he was withholding a decision until the subsidy bill was acted on.

Since the President delayed action following the Tariff Commission's recommendation by more than the 60 days provided by law, firms opposed to increases may take it to the Federal Courts if he raises them.

The severe financial troubles of countries largely dependent on exports of metals to the U.S. has become more obvious in the past six months. This and the better outlook for the economy may cause the President to postpone a decision for several months and possibly to deny an increase. The international meetings in London Sept. 8 through 14 to discuss possible commodity agreements in lead, zinc and copper, though likely to lead only to further discussions at some later date, may make it easier for the U.S. Government to defer any active aid to mining companies. Possibly the only direct aid by the U.S. Government will be in connection with barter of U.S. agriculture surplus for minerals.

Provision for continued barter was made by Congress when it extended Public Law 480. The law is different in several important ways from the earlier law. 1) The former law provided that the Secretary of Agriculture was to make barter transactions whenever it appeared to be to the interest of U.S. agriculture. The new law is broader—he is to act whenever it is in the interest of the U.S. 2) The former law provided that the Secretary would decide the kind and amounts of materials that would be accepted in barter. The new law specifies the President will make these decisions. 3) The new law states that barter is to be carried out so as to preserve "the usual marketing patterns." In the old law the requirement that barter transactions be in addition to regular cash sales was not spelled out—the Secretary made this interpretation. In the new law "additionality" is specifically mentioned. But whether the burden of proof of additionality rests with the firm making a barter proposal (the present system) or if the proof of lack of additionality rests with the Department, must wait on legal opinions from the Department of Agriculture. The wording of the bill and the report of the Senate and House committees can be interpreted either way.

All barter transactions now must wait on 1) signing of the bill by the President (he will probably have acted by the second week of Sept.), 2) an order from the President as to the kinds and amounts of acceptable barter materials and 3) legal decisions on the uncertain aspects of the bill. Probably the committee appointed by the President last year on stockpiling will have an important part in determining the kinds and amounts of materials.

Sales of copper in August in the U.S. were better than in July and about equal to June sales. Sales abroad, as shown by reports to *E&MJ* by the major copper producers and custom smelters, were lower in August than in July and earlier months. Deliveries reported by Copper Institute in July were down about 23,000 from June's high figure and were the lowest of the year. July is usually the lowest month each year. Deliveries outside the U.S. were 143,278 tons; only in March of this year were they higher than this. Shipments of copper products by U.S. fabricators in July were down about 30,000 tons to 79,353, the lowest month of the year.

Kennecott announced early in August it was going from 4 days per week to 5 for its U.S. mines. This increases its annual output by between 45,000 and 50,000 tons. Beginning Sept. 8 it is raising its operations to a 6 day basis. The total increase amounts to about 95,000 tons. Phelps Dodge is raising output 42,000 annual rate. With total stocks of copper at about 475,000 tons, some factors were much surprised at these increases. But it is apparent stocks are unevenly held.

Copper prices were fairly steady in August. But U.S. custom smelters dropped from 27c to 26½c in the first week of August and to 26c during the last few days of the month. U.S. producers stuck to the 26½c price and the LME, which began the month at £209 ¾ prompt bid, dropped by about nine pounds by the end of the month but recovered about four pounds by Sept. 2.

Cocom, the Coordinating Committee of the North Atlantic Allies, removed the embargo in exports to Russian countries for all forms of copper. Much copper wire had been contracted for by the Russians so they may not seek much copper in other forms.

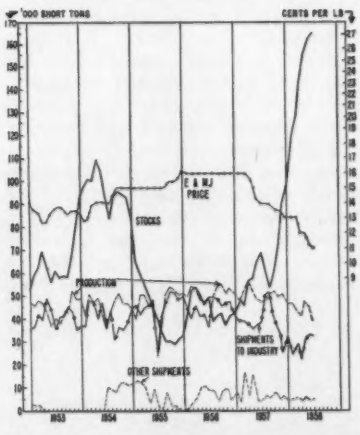
U.S. aluminum producers evidently believe the outlook for aluminum in the U.S. is improving. Kaiser announced its output is up to 84% of capacity, an annual rate of 452,000 tons. Reynolds also said it is increasing production.

Lead sales in August were lower than July. Congress rejected the lead subsidy bill but this had little effect on London lead. St. Joseph Lead Co. cut operations to 4 days from 5 following defeat of the subsidy bill. In July U.S. stocks of lead rose about 1,000 tons and output dropped about 6,000 tons. A leading custom smelter cut the price to 10¾c per lb N.Y. August 13. Other sellers followed. This cut brought it to within .1c of the LME prompt bid price after addition of the duty and transport costs to the U.S.

Zinc sales in August changed little from the preceding months. Zinc in London ended the month about £1 under the beginning of the month. American Zinc Institute data show shipments up about 5,500 tons in July and production down about 1,500 tons.

Tin on the LME jumped about £ 15 to £745 Sept. 1 following an announcement that the U.K., Denmark and Holland would restrict imports from Russia. The following day it dropped back to £740. Some factors feel it possible Russian tin sold elsewhere may continue to exert a depressing effect on the LME but it is uncertain that it will press the price back to the support level.

Primary Refined Lead Data



Data, except price, from the American Bureau of Metal Statistics. "Other Shipments" refers to shipments to the U.S. Government. The price is the *E&MJ* weighted average, N. Y. Data through July.

Average Prices August *(E&MJ Quotations)*

Copper:	
Electrolytic, domestic refinery	26.088
Electrolytic, export refinery	25.179
Lead:	
Common, New York	10.856
Common, St. Louis	10.656
Silver and sterling exchange:	
Silver, New York, per oz.	88.625
Silver, London, pence per oz.	75.000
Sterling Exchange	280.511
Zinc:	
Prime, Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
Tin:	
New York Straits	94.933
Gold per oz. U. S. price	$35.000
Quicksilver, per flask	$237.769
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$61.000
Cadmium (a)	155.000
Cadmium (b)	155.000
Cadmium (c)	155.000
Aluminum, 99% plus ingot	26.782
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers quotations.
(b) Cadmium average based on the average of the producers' and platers' quotations.
(c) Cadmium average based on platers' quotation.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

International gold transactions declined for the second month, shrinking 43½% in volume. Coin prices rose fractionally in most European markets but gained 3% in Central Europe. Bar gold prices were generally unchanged. Russia again abstained from selling gold. Near Eastern centers reported light trading while some Far Eastern markets showed increased activity. U. S. dealings gained in volume. Quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	July 31	Aug. 31	July 31	Aug. 31
NEW YORK, transit			$35.08½	$35.08½
MANILA	$41.75	$42.00	35.75	35.80
HONG KONG	46.60	46.85	38.35	38.45
BOMBAY	56.00	57.60	55.75	56.00
TANGIER	40.35	40.40	35.21	35.20
BEIRUT	42.65	42.35	35.25	35.24
PARIS	41.20	41.15	36.30	36.15
BUENOS AIRES	39.10	39.45	36.35	35.40

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of August reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅜c; ¼c deducted for selling common.

Delivered Consumers' plant	26.125 lb
F.o.b. refinery	25.725 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Aug. 1958	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	26.150	25.425	11.000	10.800	10.500	10.000	24.429	95.500
2	— No Market —		11.000	10.800	10.500	10.000	24.498	95.500
4	26.100	25.700	11.000	10.800	10.500	10.000	24.700	95.750
5	26.100	25.525	11.000	10.800	10.500	10.000	24.700	95.750
6	26.100	25.475	11.000	10.800	10.500	10.000	24.700	95.750
7	26.100	25.200	11.000	10.800	10.500	10.000	24.700	95.500
8	26.100	25.050	11.000	10.800	10.500	10.000	24.700	95.375
9	— No Market —		11.000	10.800	10.500	10.000	24.700	95.375
11	26.100	25.325	11.000	10.800	10.500	10.000	24.700	95.375
12	26.100	25.475	11.000	10.800	10.500	10.000	24.700	95.125
13	26.100	25.175	11.000	10.800	10.500	10.000	24.700	94.750
14	26.100	25.275	10.750	10.550	10.500	10.000	24.700	94.375
15	26.100	25.225	10.750	10.550	10.500	10.000	24.700	94.125
16	— No Market —		10.750	10.550	10.500	10.000	24.700	94.125
18	26.100	25.350	10.750	10.550	10.500	10.000	24.700	94.000
19	26.100	25.350	10.750	10.550	10.500	10.000	24.700	94.250
20	26.100	25.300	10.750	10.550	10.500	10.000	24.700	94.500
21	26.100	25.375	10.750	10.550	10.500	10.000	24.700	94.750
22	26.100	24.800	10.750	10.550	10.500	10.000	24.700	95.000
23	— No Market —		10.750	10.550	10.500	10.000	24.700	95.000
25	26.100	24.400	10.750	10.550	10.500	10.000	24.700	94.875
26	26.100	24.950	10.750	10.550	10.500	10.000	24.700	94.875
27	26.100	24.925	10.750	10.500	10.500	10.000	24.700	94.625
28	25.850	24.700	10.750	10.550	10.500	10.000	24.700	94.500
29	26.050	24.750	10.750	10.550	10.500	10.000	24.700	94.750
30	— No Market —		10.750	10.550	10.500	10.000	24.700	94.750
AVERAGES FOR MONTH								
Aug.	26.088	25.179	10.856	10.656	10.500	10.000	24.682	94.933
AVERAGES FOR WEEK								
Aug.								
6	26.100	25.475	11.000	10.800	10.500	10.000	24.700	95.750
13	26.100	25.245	11.000	10.800	10.500	10.000	24.700	95.250
20	26.100	25.300	10.750	10.550	10.500	10.000	24.700	94.229
27	26.100	24.890	10.750	10.550	10.500	10.000	24.700	94.854
CALENDAR WEEK AVERAGES								
Aug.								
2	26.110	25.140	11.000	10.800	10.500	10.000	24.155	95.667
9	26.100	25.390	11.000	10.800	10.500	10.000	24.700	95.583
16	26.100	25.295	10.875	10.675	10.500	10.000	24.700	94.646
23	26.100	25.235	10.750	10.550	10.500	10.000	24.700	94.583
30	26.040	24.745	10.750	10.550	10.500	10.000	24.700	94.729

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Aug. 1958	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1	88.625	75.000d.	280.5000	250s. 4¼d.	$35.00
2	(e)	(e)	(e)	(e)	35.00
4	88.625	Holiday	280.6062	Holiday	35.00
5	88.625	75.000d.	280.6875	250s. 2d.	35.00
6	88.625	75.000d.	280.7062	250s. 2d.	35.00
7	88.625	75.000d.	280.8281	250s. 2¾d.	35.00
8	88.625	75.000d.	280.8125	250s. 1½d.	35.00
9	(e)	(e)	(e)	(e)	35.00
11	88.625	75.000d.	280.6875	250s. 1½d.	35.00
12	88.625	75.000d.	280.4375	250s. 4d.	35.00
13	88.625	75.000d.	280.5000	250s. 3¾d.	35.00
14	88.625	75.000d.	280.5625	250s. 3½d.	35.00
15	88.625	75.000d.	280.4687	250s. 1¾d.	35.00
16	(e)	(e)	(e)	(e)	35.00
18	88.625	75.000d.	280.5625	250s. ¾d.	35.00
19	88.625	75.000d.	280.5000	250s. ¾d.	35.00
20	88.625	75.000d.	280.5625	250s. 1d.	35.00
21	88.625	75.000d.	280.6250	250s. ½d.	35.00
22	88.625	75.000d.	280.5937	250s. 0d.	35.00
23	(e)	(e)	(e)	(e)	35.00
25	88.625	75.000d.	280.4687	250s. 2d.	35.00
26	88.625	75.000d.	280.3500	250s. 3½d.	35.00
27	88.625	75.000d.	280.1718	250s. 5¼d.	35.00
28	88.625	75.000d.	280.0625	250s. 6½d.	35.00
29	88.625	75.000d.	280.0312	250s. 8d.	35.00
30	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
Aug.	88.625	75.000d.	280.511	—	35.00
AVERAGES FOR WEEK					
Aug.					
6	88.625	—	280.600	—	35.00
13	88.625	—	280.653	—	35.00
20	88.625	—	280.531	—	35.00
27	88.625	—	280.442	—	35.00

Calendar Week Averages: New York Silver: Aug. 2nd, 88.625; 9th, 88.625; 16th, 88.625; 23rd, 88.625; 30th, 88.625.
(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differencial for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western: Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

Aug.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	209½	210	210	210¼	72	72½	73	73¼	64¾	65	65¼	65½	730½	731½	733	734
4	Holiday															
5	209½	210	210	210¼	72¾	72½	73¾	74	64¾	65	65½	65¾	730	731	734½	735
6	208¼	208½	208½	208¾	72¾	72½	73½	73¾	64½	64¾	65¼	65⅝	731	731½	736½	737
7	203¼	203½	203¾	204	72¼	72⅝	73	73½	64¼	64½	65	65¼	730½	731	734	734½
8	207¼	207½	207½	207¾	72	72½	73	73¼	64⅝	64⅞	65¼	65⅝	730	731	734	734½
11	207½	208	208	208¼	71¼	71⅝	72½	72¾	64¼	64½	65	65¼	730	730½	733	734
12	206¼	206½	206¾	207	70¾	71	72¼	72½	64⅛	64¾	64¾	64⅞	730	730½	732½	733
13	205¼	205¾	206	206¼	70	70¼	72	72¼	63⅝	63⅞	64⅜	64¾	730	730½	731	731½
14	206½	206¾	206¾	207	69¼	69½	71	71¼	63½	63¾	64½	64⅝	730	730½	730	730½
15	207½	208	207¾	208	69¾	70	71¼	71½	63¾	64	64½	64¾	730	730½	728½	729
18	208	208¼	208	208¼	69½	70	71	71¼	63¼	63½	64¼	64½	730	730½	726½	727
19	206¼	206½	206¼	206½	69¾	69⅞	71⅛	71¼	62⅞	63	63¾	64	720	730½	728½	729
20	206¾	207	207	207½	69	69¼	70⅝	70¾	62½	62¾	63¼	63½	730	730½	730	730½
21	207½	207¾	207½	207¾	68⅞	68	69⅝	69¾	62	62¼	62⅝	62¾	730	730½	730	730½
22	200	200¼	200	200½	69	69¼	70¾	71	63¼	63¾	64	64¼	730	730½	730	730½
25	204	204¼	204	204½	70¼	70⅝	71¾	71⅞	64	64¼	64¾	65	730	730½	730½	731
26	203¼	203¾	203¾	204	69¼	69½	71⅛	71¼	63½	64	64¼	64½	730	730½	730½	731
27	203¼	203½	203½	203¾	69	69½	70⅞	71	63¼	63½	64⅛	64¼	730	730½	730½	731
28	201	201½	201½	201½	69½	69¾	71¼	71⅝	63½	63¾	64¾	64½	730½	731	730½	731
29	202	202¼	202¼	202½	69¾	70	71¾	71⅞	63¾	64	64¾	64½	730½	731½	731½	732
Av'g's	£205.813		£206.056		£70.384		£71.853		£63.831		£64.566		£730.450		£731.550	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated. tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

August 31, 1958

Aluminum ingot, 99 plus % lb.		26.8¢
Antimony, spot, lb. less than carload, in cases		32.59¢
In bulk, carload lots, f.o.b. Laredo		29.00¢
Imported, 10 ton min. (p), 99½%		23¢
Bismuth ton lots, lb.		$2.25
Cadmium, commercial sticks, delivered, lb.		$1.55
Calcium lb. ton lots 98%, cast		$2.05
Chromium, 97% grade, lb. contract del.		$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957		$2.00
Germanium, per gram, 10,000 gram lots	(a) 37¢—(b)	40.2¢
Indium, troy oz.	$1.25 @	$2.25
Lithium, lb. 98%	$9.00 @	$11.00
Nickel, cathodes, lb (a)		74¢
Other sales, reg. sellers		74¢
Sales by dealers, etc.		74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16		35¼¢
Palladium, troy oz.	$15.00 @	$17.00
Platinum (wholesale lots), troy oz.	$56 @	$65
Quicksilver, flask of 76 lb., 25 flasks or more	$239 @	$243
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 97%, carloads, lb.		21¢
Semi-Conductor grade, lb.		$350
Tellurium, lb.		$1.65
Thallium, 100 lb. or more, lb.		$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)		$2.05

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective April 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	— (a)	—
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:		
44% Cr_2O_3 no ratio	$22 @	$23
48% Cr_2O_3 3 to 1 ratio	$44 @	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:		
Old Range bessemer		$11.85(c)
Mesabi bessemer		$11.60(c)
Mesabi, non-bessemer		$11.45(c)
Lead (Galena), 80%, Joplin, Mo., ton		$123.72
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included $1.05 @ $1.10; both duties excluded, $.915 @ $.965. Long-term contract nominal.		
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18 @	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.05 @	$1.10
Tungsten Ore, per stu of WO_3:		
Foreign 60%, c.i.f. U. S. ports, duty extra	$8 @	$9
U. S. scheelite, f.o.b. mill	$16 @	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines		31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton		$56

(a) Nominal.
(e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered		5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52 @	$1.55
Copper Sulphate, 100 lb eff. July 2, '58		$11.05
Germanium Oxide, gram		27½¢
Molybdic trioxide, technical, per lb. of Mo	1.38 @	$1.41
Imported, incl. 37¢ duty	.75 @	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)		28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.		12¼¢
Ferromolybdenum, 58 to 64% Mo, lb. of Mo contained	$1.68 @	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)		14.20
		$2.15
Ferrotungsten, 72 to 82%, lb. of W contained	$3.20 @	$3.40
Ferrovanadium, per lb. of V delivered		12.8¢
Silicomanganese, max. 1½% carbon, lb., contracts		$102.50
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7		

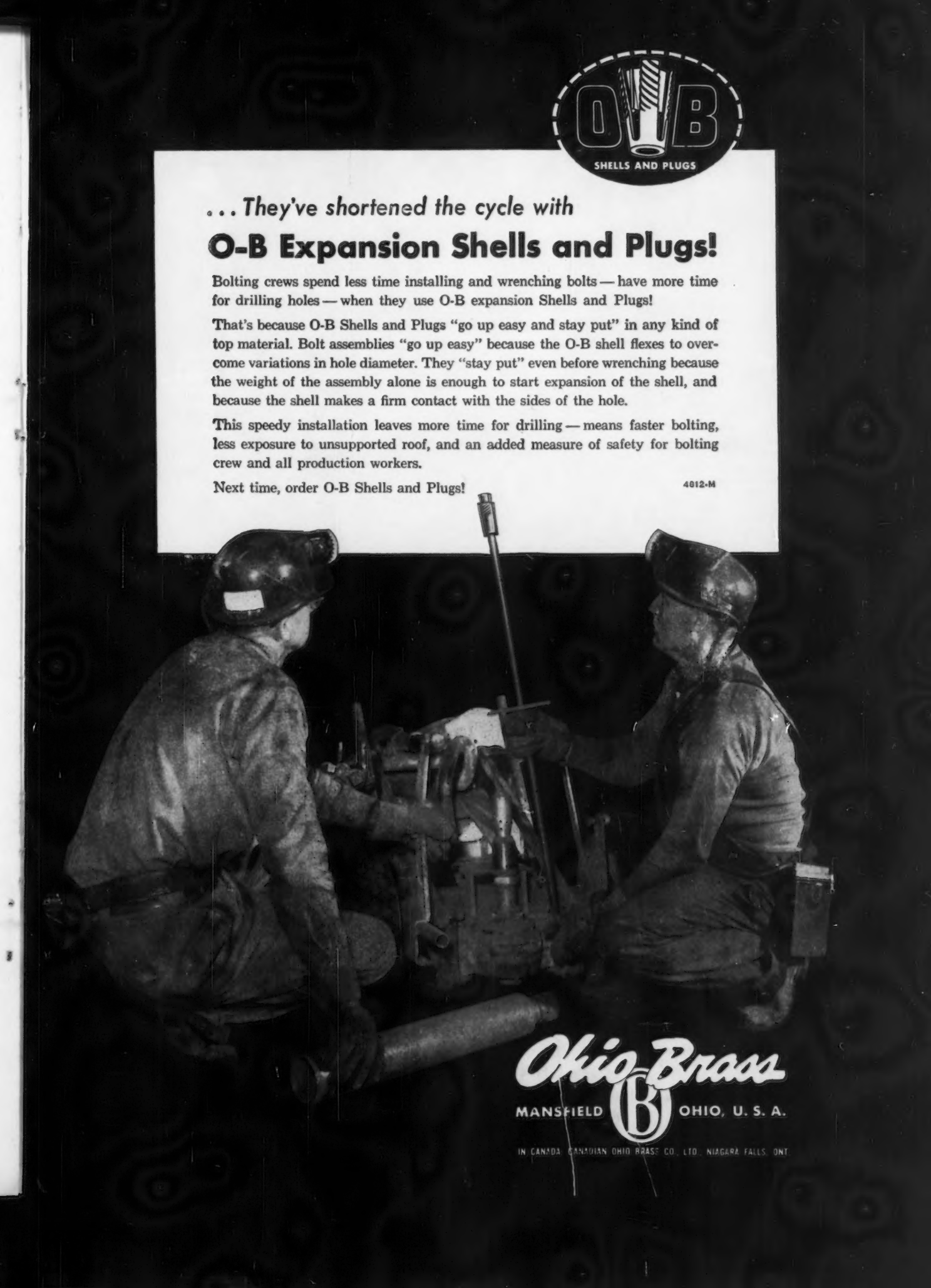
NON-METALLIC MINERALS

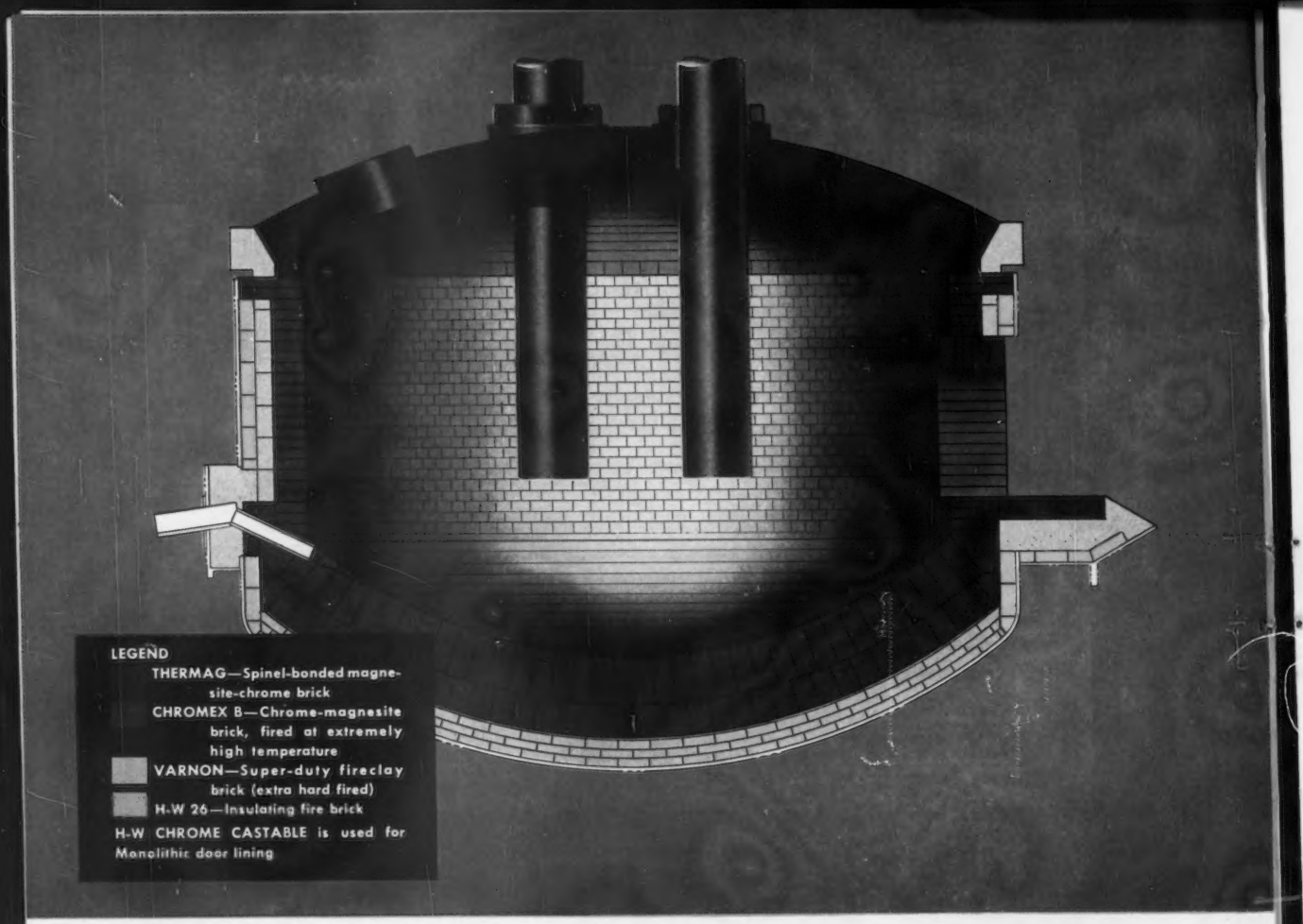
Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:		
Crude No. 1	$1,470 @	$1,810
Crude No. 2	$788 @	$1,155
Spinning fibers	$353 @	$593
Shingle fibers	$190 @	$220
Paper stock	$120 @	$142
Waste	$82 @	$86
Shorts	$27 @	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):		
Crude No. 1		$1,522
Spinning fibers	$494 @	$787
Shingle fibers	$142 @	$325
Asbestos, Vermont, f.o.b. Hyde Park:		
Spinning fibers	$353 @	$183
Shingle stock	$172 @	$190
Paper stock	$114 @	$145
Waste, stucco or plaster		$82
Refuse or Shorts	$39 @	$72
Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94% $BaSO_4$, per short ton	$16 @	$18
Crude oil well grade, min. 4.3% sp. gravity, at (a)		$18
Imported, c.i.f. Gulf Ports, at	$16 @	$18
Bauxite, long ton, f.o.b. point of shipment:		
Domestic, crude, 50 to 52% (not dried) (c)	$ 5.00 @	$5.50
Domestic, chemical, 55 to 58% (c)	$ 8.00 @	$8.50
Domestic, abrasive, 80 to 84% (c)	$18.00 @	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @	$22.50
Glass feldspar, white, 20 mesh	$10 @	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 @	$41
60% effective CaF_2	$33 @	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)		$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4 inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8 inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap, $20 @ $30.		
Ocher, Georgia, ton, in sacks	$26.50 @	$32.00
Pyrites, Spanish, per long ton unit of S, c.i.f. atlantic ports		Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright		$23.50
dark		$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40 @	$11.60
For export f.o.b. vessel, lt, dep. on grade	$22 @	$24
Talc, f.o.b. works, ton:		
New York, purified	$18.00 @	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc, 100 lb.	@ $5.30	$ 5.50


O B
SHELLS AND PLUGS
. . . They've shortened the cycle with
O-B Expansion Shells and Plugs!
Bolting crews spend less time installing and wrenching bolts — have more time for drilling holes — when they use O-B expansion Shells and Plugs!
That's because O-B Shells and Plugs "go up easy and stay put" in any kind of top material. Bolt assemblies "go up easy" because the O-B shell flexes to overcome variations in hole diameter. They "stay put" even before wrenching because the weight of the assembly alone is enough to start expansion of the shell, and because the shell makes a firm contact with the sides of the hole.
This speedy installation leaves more time for drilling — means faster bolting, less exposure to unsupported roof, and an added measure of safety for bolting crew and all production workers.
Next time, order O-B Shells and Plugs!
4812-M
Ohio Brass
MANSFIELD OHIO, U. S. A.
IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.


LEGEND
THERMAG—Spinel-bonded magnesite-chrome brick
CHROMEX B—Chrome-magnesite brick, fired at extremely high temperature
VARNON—Super-duty fireclay brick (extra hard fired)
H-W 26—Insulating fire brick
H-W CHROME CASTABLE is used for Monolithic door lining

Harbison-Walker refractories used in the world's largest

ELECTRIC COPPER MELTING FURNACE

at American Smelting and Refining Company, Perth Amboy, New Jersey

Exterior view of world's largest electric copper melting furnace (courtesy of ASARCO)

The Harbison-Walker refractories which are particularly suited for use in the different furnace positions as here graphically illustrated, assure long, economical service. These brands are making records in electric copper melting furnaces at various refining plants.

THERMAG and CHROMEX B brands are selections for this electric furnace requirement, from a full score of Harbison-Walker basic refractories, many of which are widely used in copper smelting and refining practice. Among these, several of the leaders are:

- CHROMEX B—giving outstanding service in anode and wire-bar furnace side walls and in converters.
- METALKASE—steel encased basic brick, both plain and internally plated. Made in various sizes and in suspended arch shapes used for roofs of refining and matte smelting furnaces.
- H-W MAGNESITE—consisting predominantly of stabilized periclase. This brand of refractory provides the most strongly basic linings for greatest resistance to severe fluxing by basic slags.

In addition, Harbison-Walker products include all types and classes of refractories for every metallurgical furnace need.

HARBISON-WALKER REFRACTORIES CO.

AND SUBSIDIARIES GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

"We bought 1 Tournatractor® to replace 2 crawlers"

says pit manager James W. MacDonald

At their Lynchburg Stone Division Pit in Concord, Va., Rockydale Quarries Corporation produces up to 2,000 tons of crushed limestone daily. To meet production requirements, 2 crawler-tractors were used on scattered maintenance assignments around the pit and plant. Since distances between the multiple-tractor jobs ranged up to ½ mi., the slow-moving crawlers lost valuable work-time when traveling job-to-job. What's more, track maintenance ran high because of travel distances over the abrasive footing.

So Rockydale Quarries looked for a more economical type of tractor. They found it in the rubber-tired LeTourneau-Westinghouse Tournatractor. Says pit manager James W. MacDonald, *"We bought 1 Tournatractor to replace 2 crawlers, and also to cut track repair costs. It's very successful... we like its speed and versatility."*

Tournatractor quickly clears blasted rocks from watery pit floor. Operator Rodney Arthur says, "Tournatractor is easy to operate. It's powerful, runs good and is *fast*. With a crawler it used to take me 16 min. to go from pit to plant... but with Tournatractor it takes only 2 or 3 min.!"

All-around handyman tool

Lynchburg Stone Division Pit uses their Tournatractor — equipped with 14'10" long Angledozer® blade — as an all-around handyman tool (note sketch). This speedy, rubber-tired tractor cleans-up after blasts and around shovels. It handles general dozing, moves wagon-drills on pit rim, assists stalled trucks, and maintains stockpile. When shovel at plant is down for repairs, Tournatractor takes over... pushes rocks from surge pile to hopper, to insure uninterrupted plant production. Rubber-tired tractor also is used to push-load pit's Handyman D Tournapull® scraper on stripping and road-building operations.

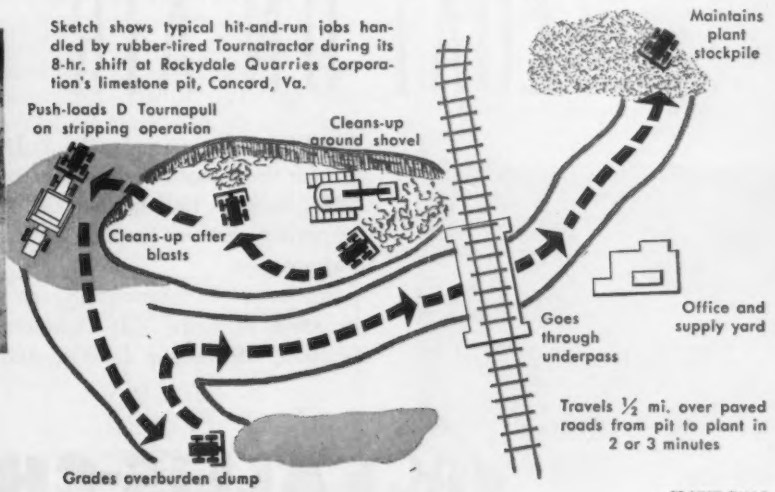
Commented pit foreman Jabe S. Ferguson Jr., "We're all strung out between quarry, plant, and stripping-ends on quarry rim. The Tournatractor hustles back and forth... works all over the place. It does a good job."

Try Tournatractor at your pit

If your pit operation is widely scattered or involves abrasive material, why not investigate rubber-tired LeTourneau-Westinghouse 210 hp Tournatractor? You'll find this speedy tractor completes scattered jobs faster, at lower cost. Let us arrange to demonstrate versatile Tournatractor at your pit. No obligation.

Between dozing assignments, 210 hp Tournatractor push-loads 7½-yd. D Tournapull (new "D" has 9-yd capacity) with red and blue clay overburden. Pit also owns a L-W Rear-Dump hauler which is easily interchanged with scraper... increases "D" prime-mover's usefulness.

Sketch shows typical hit-and-run jobs handled by rubber-tired Tournatractor during its 8-hr. shift at Rockydale Quarries Corporation's limestone pit, Concord, Va.


Maintains plant stockpile
Push-loads D Tournapull on stripping operation
Cleans-up around shovel
Cleans-up after blasts
Goes through underpass
Office and supply yard
Travels ½ mi. over paved roads from pit to plant in 2 or 3 minutes
Grades overburden dump

CT-1707-QMJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

FIRST

NOW — Allis-Chalmers Vibrating Screens

FLOAT ON AIR

NEW cars, modern trucks and trains utilize air springs for the smoothest, best controlled ride obtainable. Now Allis-Chalmers has applied the *same type air springs to vibrating screens* to provide greatly improved screen performance.

For complete information, see your nearby A-C representative, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis. Ask for Bulletin 07B8931.

A-C ALLIS-CHALMERS

A-5662

ALLIS-CHALMERS

Use same L-W prime-mover in stripping and hauling

You save on original equipment investment . . . and reduce operating costs

Stripping overburden is different from mining out pay ore or rock. It is basically a *scraper* job—can be handled most economically by modern scrapers. They leave your shovels and haulers free to maintain steady production.

Yet, since stripping is not a continuous operation in most pits, you need a multi-purpose machine — one that can quickly switch over to hauling shovel-loaded material when you catch up on stripping of overburden.

You get this advantage with the LeTourneau-Westinghouse Tournapull® line. These L-W machines keep equipment investment and operating costs low *all year long* because of their interchangeability feature (see panel). The prime-mover—major part of your original machine investment—interchanges with a variety of profit-making work trailers for other specialized duties. They handle your stripping, land-leveling, roadbuilding, pit-hauling, and waste product disposal efficiently, and at low cost.

Cut costs on your operation

The next time you consider investing in new stripping or hauling machinery, investigate Tournapull. Ask about the multiple work bonus you get (at fractional cost) from its interchangeable L-W trail units. Ask for specifications and prices on all 3 sizes. All have road speeds of close to 30 mph, ability to turn 180° non-stop in less than their own length.

L-W Tournapull Scrapers in 3 Sizes

Size	Diesel HP	Maximum MPH	Bowl Yards	Capacity Tons
B	335*-325	30.0	28	32.5
C	210	29.9	18	20.0
D	138	29.5	9	10.0

*when torque converter is specified

Interchangeable Rear-Dump

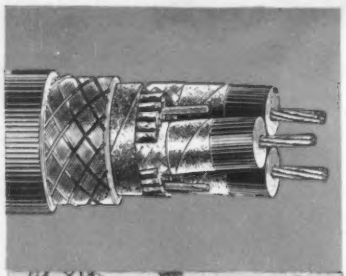
Tournapull scrapers interchange with other L-W trailing units behind the same prime-mover. For pit work, the Rear-Dump offers economical hauling ability, and simple operation — plus all the advantages of Tournapull speed and mobility. Bowl capacities are 35, 22, and 11 tons. Other L-W trailing units, suitable for pit and quarry work, include bottom-dump and side-dump haulers.

P-1860-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



Meanwhile, back at the mine . . . the power shovel was still going strong. This is the kind of performance mine operators have come to expect from Simplex **TIREX®** cords and cables. No cable should ever be subjected to such abuse, of course, but sometimes it does happen. And that's an excellent reason why you should use Tirex. Tirex, with its cured-in-lead, fortified and tempered neoprene armor, is designed to resist the toughest sort of punishment, give you long, dependable service.

BENDS without BREAKING
TWISTS without KINKING
SNAKES without SNAGGING

LIVE BETTER ELECTRICALLY

Simplex **WIRE & CABLE** COMPANY
79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"The American manufacturers of transoceanic telephone cables"

North...south...east...or west...

pit owners cut costs with rugged pivot-steer haulers

From Georgia to Wisconsin... from Virginia to California... pit owners are operating under widely varying job and weather conditions. But there's one thing all pits shown have in common... the type hauler they bank on to cut pit costs. It is the rugged LeTourneau-Westinghouse Tournapull® Rear-Dump.

Wherever they operate, these machines dump clean and fast... clear over banks, or into hopper. Front-wheel drive holds Rear-Dump steady and safe at soft bank-edge. Units have big, wide, all-steel bodies for fast loading and low maintenance. And, go-anywhere 'Pulls* haul through mud or slippery going where conventional haulers would have to call it "quits."

Read these owner-verified reports... then give us a call. We'll be happy to show you how these electric-control Tournapull Rear-Dumps can fit into *your* operations to help *you* cut pit costs. Three sizes: 11, 22, and 35 tons; with 138, 210, 300 or 335 hp diesel engines.

N

Wisconsin gravel pit — In an effort to step-up production and cut hauler maintenance expense, this large gravel pit replaced a fleet of trucks with 3 Tournapull Rear-Dumps — 2 "D's" and a "C". Says pit superintendent, "Most truck bodies are too thin. Our work is also too hard on truck tires, transmissions, differentials, springs, and drive shafts. These rugged L-W units outlast ordinary haul trucks 10 to 1."

Virginia limestone pit — 3 D Rear-Dumps replace 10 trucks... together, haul 1000 tons of rock to crusher per 8½-hr day. Comments owner, "We went through $56,000 worth of trucks in 5 years before we switched to Tournapull Rear-Dumps. These machines are the only thing for hauling rock. Trucks just can't compare." Says operator, "They're as simple to run as a car. I like 'em fine!"

W E

California quarry — Tough underground tunneling operations required a rugged hauler that could maneuver in extremely cramped quarters, haul over narrow, winding roads. Pit owner's choice — 3 C Tournapulls with 22-ton Rear-Dumps. Unit is shown making continuous 180° turn (with body in dump position) in area just 20'8" wide. Electric controls also contributed to ease of operation and safety.

Georgia kaolin pit — Despite wet, slippery roads, 2 D Tournapulls with 11-ton Rear-Dumps haul sand and red clay overburden 500' to dump in 1 min 24 sec. With electric-hoist, bowl can be lifted for full, instant dump, or held at any angle for slow, precision feeding into hopper. Mine superintendent likes 'em, "cause they're easy to maneuver... pull themselves easily out of soft footing."

S

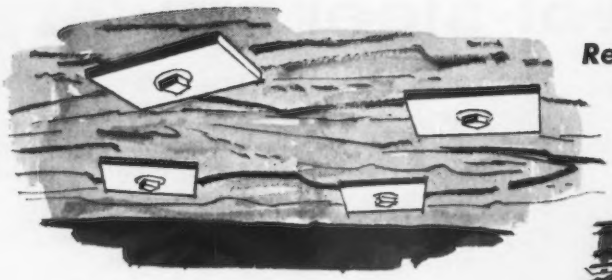
*Trademark R-1836-MQJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

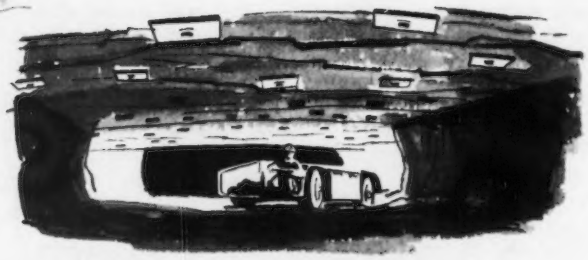
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Here's why it pays to bolt your roof

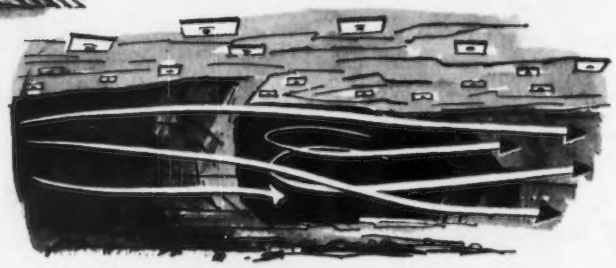


Reduces rock falls . . . improves safety

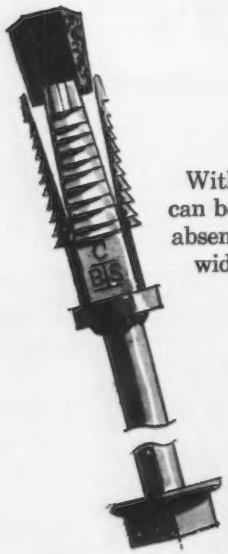


Permits wide haulageways . . . increases clearance

Makes mechanized equipment easier to maneuver



Improves ventilation . . . no bulky supports to store



With roof bolting, mechanized equipment can be worked close to the face, due to the absence of bulky supports. In addition to permitting wide openings and clearances, roof bolting also improves ventilation . . . minimizes the need for storage space . . . eliminates fire hazards.

Bethlehem Headed Roof Bolts In 3 Diameters

To meet virtually every roof condition, Bethlehem makes headed roof bolts in 3 diameters: $\frac{5}{8}$ in., $\frac{3}{4}$ in., and $\frac{7}{8}$ in., having typical breaking loads of from 24,000 lb for the $\frac{5}{8}$-in. bolt to 45,000 lb for the $\frac{7}{8}$-in. bolt.

If you'd like to know more about roof bolting, write us at Bethlehem, Pa., and we'll have a representative call at your convenience.

SLOTTED BOLTS, TOO. For use in certain types of rock, Bethlehem also makes a 1-in. slotted roof bolt, which is used with a steel wedge. Ask for details.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Announcing the Mission

HAMMERDRIL

Trade Mark — Patents Issued And Pending

Hammerbit
Patents Pending
Trade Mark

A "bottom-hole" air-operated impact tool for high speed, low cost drilling of hard rock formations

- **TROUBLE-FREE SERVICE –**

  Two moving parts in high pressure tool and *only three* moving parts in the low pressure tool.

- **FASTER PENETRATION –**

  — because all the air is used to drive the extra-heavy hammer and then pass through bit nozzles to remove cuttings.

- **STRAIGHT, FAST, FULL-GAGE HOLE –**

  — results from high impact efficiency and advanced bit design.

THE MISSION HAMMERBIT

This bit is designed for use with the Hammerdril. It features six massive tungsten carbide inserts placed to produce maximum cutting efficiency and straight, full-gage hole. Mission Hammerbits may be resharpened in the field many times.

The Hammerdril has been developed and field tested for over eight years and is backed by a company with over 30 years' experience manufacturing oil well drilling equipment. If you do any hard rock drilling, it will pay you to get more information. Just fill in the coupon.

Visit us at booth 212, American Mining Congress, 1958 Mining Show San Francisco, September 22-25.

Nothing but the finest will bear the name of

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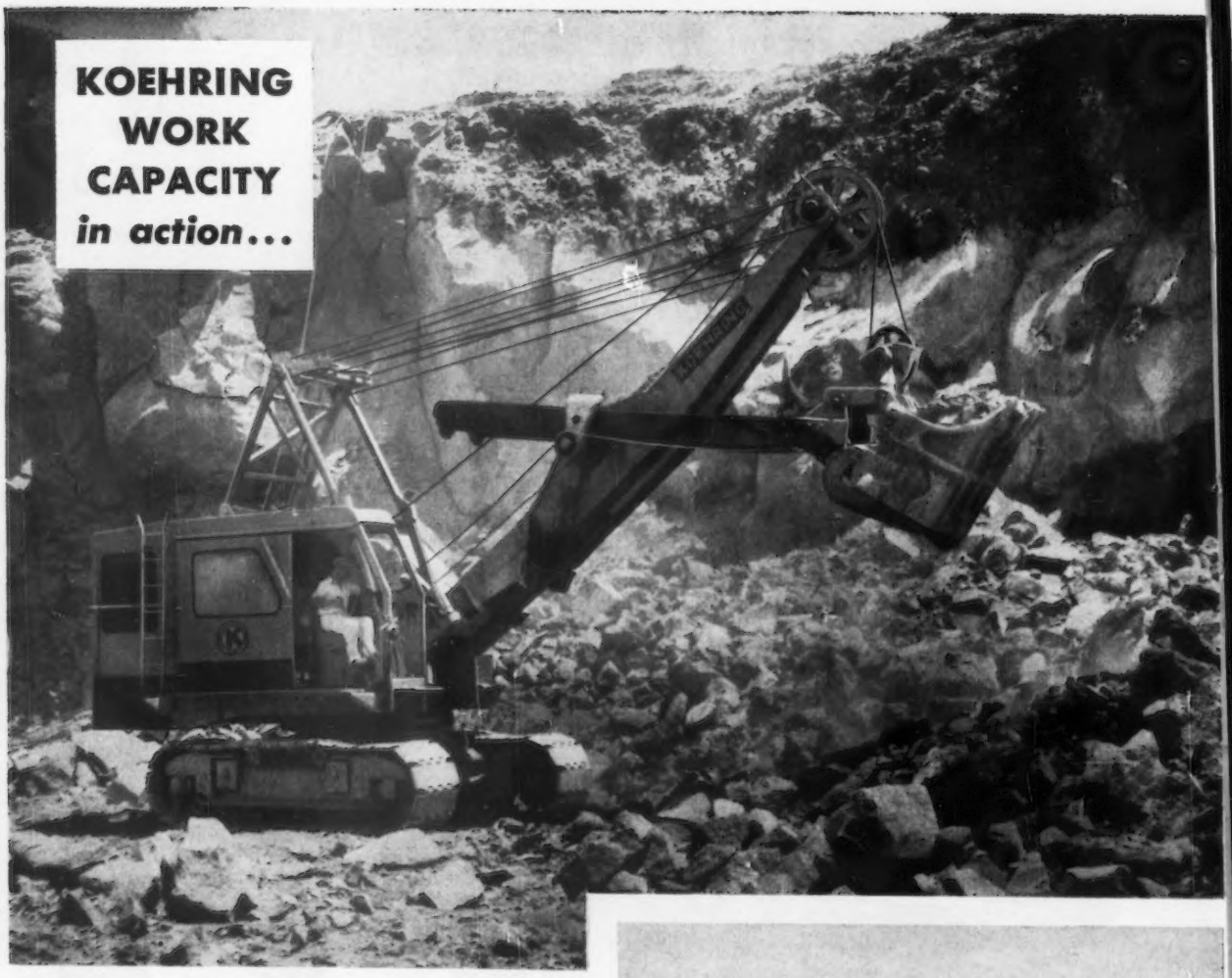
KOEHRING WORK CAPACITY *in action...*



Heavy-duty rock shovel — Owner of this quarry used a Koehring® 1½-yard 605 to load out blasted rock. Powerful, 2-section chain crowd, and rugged digging strength of its deep-section boom and dual dipper sticks proved more than a match for the heavy rock. It's shown here with 22-foot boom, 16½-foot sticks — also available with 28-foot high-lift boom and 23-foot sticks. Strength and stability as a shovel increase the 605's work capacity with all attachments. For proof — check its lift rating in Koehring chart on opposite page.

Long-reach dragline — Here's a special size machine that fills a production gap on many operations — the Koehring 805. It handles 2 to 3-yard dragline bucket on 50 to 150-foot boom. Converts to clamshell, 52-ton lift crane, 2-yard shovel. Have Koehring distributor demonstrate what this big 805 will do on your stripping, stockpiling, lifting, loading.

KOEHRING DIVISION OF KOEHRING COMPANY, Milwaukee 16, Wis. . .

High-lift stripper — Look at the work range of this 1205 stripping shovel. When equipped with 3-yard dipper on 40-foot boom, it has a cutting height of 42 feet-10 inches, and dumps at 31 foot-5 inch height. That's with boom at 45° angle. Where extra reach is needed, you can use a 2½-yard dipper on 50-foot boom — and get 51 foot-4 inch cutting height, and 40 foot-10 inch dumping height, at a 45° boom angle. (For heaviest digging, a standard Koehring 1205 shovel has 3-yard dipper on 30-foot boom.) Depending on weight of materials, it also handles 3 to 4-yard dragline or clamshell buckets on 60 to 170-foot boom — details in chart below.

25-ton handyman — With its high speed mobility on rubber, Koehring 305 truck crane is a handy, heavy-duty material-handling rig around mines and quarries. Installs machinery, unloads heavy equipment and supplies — safely lifts up to 25 tons. Has full complement of clamshell, dragline, shovel or hoe attachments for all-round use.

Koehring excavators and cranes also manufactured in:
CANADA • ENGLAND • SPAIN • JAPAN

Quick facts on KOEHRING WORK CAPACITY:

MODEL	TYPE OF MOUNTING	CRANE LIFT CAPACITIES (Rubber-tired machines rated at 85% of tipping load.)	
ON RUBBER			
205	3-axle truck, or 21.5 mph Cruiser	30,000 lbs.	at 12-ft. radius
305	3-axle truck, or 18 mph Cruiser	50,000 lbs.	at 12-ft. radius
435	4-axle truck	70,000 lbs.	at 15-ft. radius
545	4-axle truck	90,000 lbs.	at 15-ft. radius
ON CRAWLERS	Size shovel	CRANE LIFT CAPACITIES (Crawler ratings based on 75% of tipping load.)	
205	½ Cu. Yd.	20,000 lbs.	at 10-ft. radius
305	¾ Cu. Yd.	30,000 lbs.	at 12-ft. radius
405	1 Cu. Yd.	40,000 lbs.	at 12-ft. radius
545	(Crane only—85% rating)	90,000 lbs.	at 12-ft. radius
605	1½ Cu. Yds.	72,300 lbs.	at 12-ft. radius
805	2 Cu. Yds.	104,200 lbs.	at 12-ft. radius
1205	3 Cu. Yds.	190,000 lbs.	at 12-ft. radius

Extra lift capacity means . . . MORE WORK CAPACITY WITH ALL ATTACHMENTS

Firestones deliver new lows in tire cost-per-hour!

From the New York Thruway to Montana's Hungry Horse Dam, contractors using Firestone Off-the-Highway tires are lengthening hours of service and reducing maintenance costs. One big reason is the extra stamina and strength that Firestone Rubber-X adds to construction equipment tires.

Another reason is the combination of Firestone Rubber-X with exclusive Firestone S/F (Shock-Fortified) nylon cord. Together they help make a tire that helps beat downtime resulting from rapid wear, cuts, snags and impact breaks. Count on Firestones to keep your equipment rolling on the toughest haul or on the tightest schedule.

See your Firestone Dealer or Store and ask the Firestone Tire Sales Expert how Firestone tubeless or tubed nylon off-the-highway tires can cut your tire costs. When you order new off-the-highway equipment, always specify Firestone tires.

FIRESTONE ON-THE-JOB SERVICE—Firestone off-the-highway tire service cuts costs, keeps equipment rolling to keep all jobs on schedule.

TUBELESS OR TUBED
Rock Grip Excavator® W. B. Rock Grip Excavator®

Firestone

BETTER RUBBER FROM START TO FINISH

Copyright 1958,
The Firestone Tire & Rubber Company

Enjoy the Voice of Firestone every Monday evening on ABC television

Made its Reputation in the
SCHOOL OF HARD KNOCKS!
Roebling SH-D Portable Power Cable

From its rugged, abrasion and weather-resistant Roeprene® Sheath, right to the heart of its extra-flexible conductors, Roebling SH-D Portable Power Cable was designed to give full-power performance. The extra quality features show you why Roebling SH-D is better in terms of superior service, ease of installation and maintenance. For more facts, write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Extra—Special semi-conducting tape around each super-flexible, stranded conductor to prevent ionization.

Extra—Butyl conductor insulation for outstanding electrical properties, plus heat, moisture and ozone resistance.

Extra—Free-riding, all-rubber fillers for moisture resistance, splicing and terminating ease, unusual flexibility.

Extra—A combination of properties which permits operation with copper temperatures up to 90° C.

To Increase Production and Lower Operating Costs...Specify

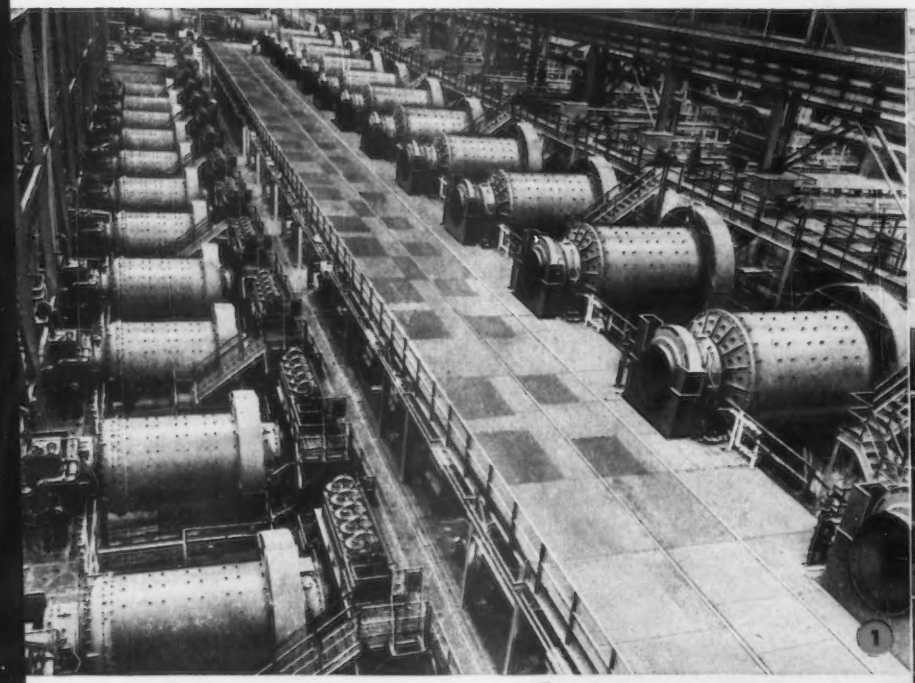
NORDBERG MINING MACHINERY

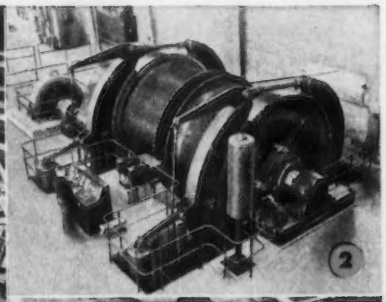
The complete line of heavy-duty Nordberg mining machinery includes Symons® Gyratory Crushers for primary breaking; Symons Cone Crushers for secondary and tertiary crushing; Grinding Mills; Symons Vibrating Grizzlies and Screens; Mine Hoists; and Nordberg Engines for mine and mill power.

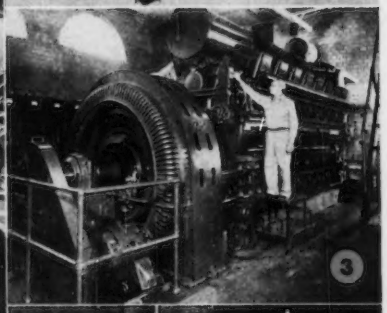
Rugged, heavy duty construction of Nordberg mining machinery assures continuous production at low operating and maintenance costs.

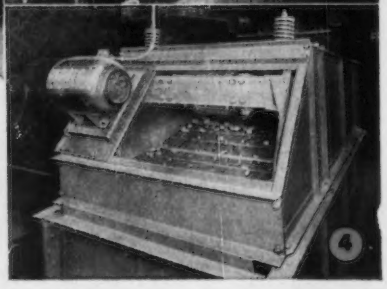
Here is mining machinery that is used by the world's leading producers of ores and industrial minerals.

Write for complete information.









1 GRINDING MILLS . . . Ball, pebble, tube, rod and compartment types for wet or dry, open or closed circuit operation. Sizes to 13' diameter and up to 50' long.

2 MINE HOISTS . . . Built in conventional drum types as well as in friction types, for hoisting both ore and men, in a wide range of sizes to meet large coal and metal mining operations.

3 NORDBERG ENGINES . . . From small power-units to large stationary plants, for Diesel, Duafuel®, and Spark-Ignition Gas operation, in sizes to over 11,000 horsepower.

4 VIBRATING SCREENS and GRIZZLIES . . . In types and sizes to meet practically all requirements from heavy scalping to fine screening applications.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

NORDBERG

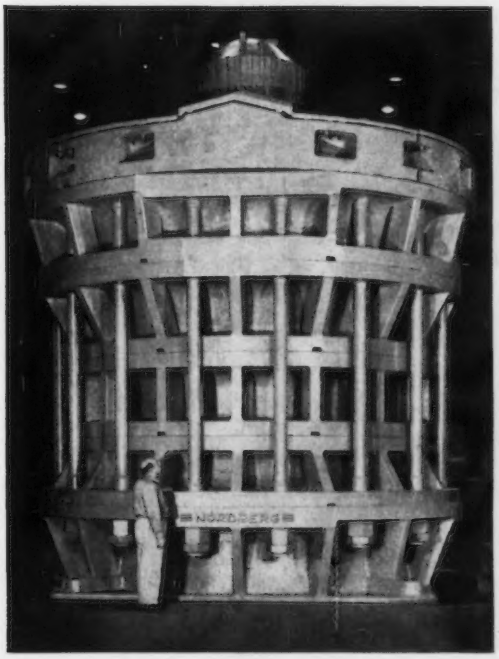
SYMONS . . . a registered Nordberg trademark known throughout the world.

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

SYMONS CONE CRUSHERS

Built in 11 different sizes, ranging from 22" to 7' dia., for capacities from 6 to 900 or more tons per hour.

(Illustrated at the right is a typical installation of Symons Cone Crushers and Rod Deck Screens serving a large Taconite Iron Ore producer).



SYMONS GYRATORY CRUSHERS

For heavy-duty primary breaking, available with feed opening sizes of 30", 42", 48", 54", 60" and 72", for capacities to 3,500 and more tons per hour.

©1958, N. M. Co.

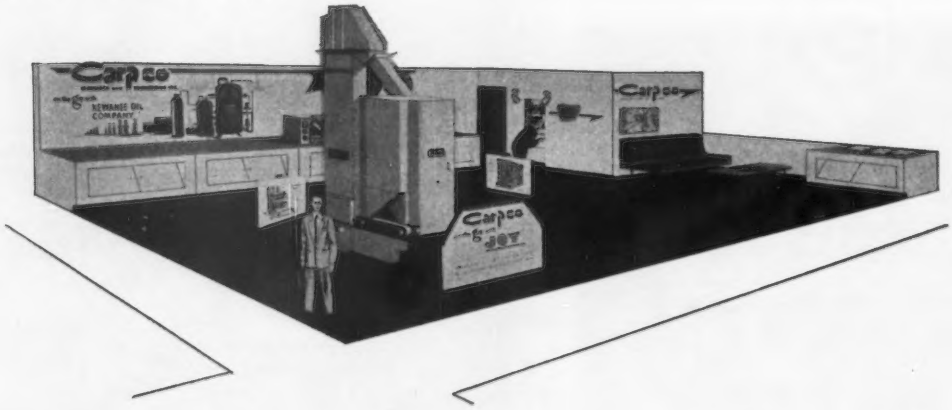
M158

***See** the Nordberg Exhibit at the big 1958 Mining Show in San Francisco!*

ON THE go

by J. Hall Carpenter

AT THE MINING SHOW in San Francisco, Carpco will be exhibiting High Tension Separators and High Intensity Induced Roll Magnetic Separators. Scheelite concentration by High Tension will be in continuous demonstration. Look for Booth 521.



ON THE GO WITH JOY MANUFACTURING COMPANY Carpco, in a joint project with Joy will exhibit an operating iron ore High Tension Separator making a continuous separation of hematite from silica.

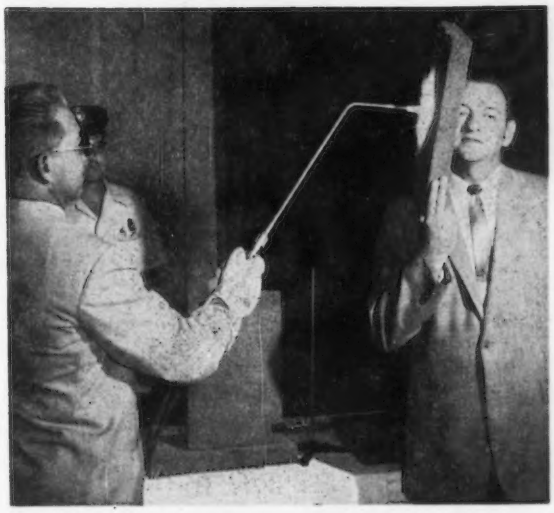
ON THE GO WITH KEWANEE OIL COMPANY Carpco, in a joint research project with Kewanee, is developing a High Tension method for the clarification and dehydration of crude oil and other emulsions. A demonstration unit will be operating.

Carpco

CARPCO RESEARCH AND ENGINEERING, INC. CARPCO MANUFACTURING, INC.
CARPCO CONSTRUCTION CORPORATION CARPCO EXPORT CORPORATION
JACKSONVILLE, FLORIDA, U. S. A.

CARPCO AUSTRALASIA, PTY. LTD. CARPCO HONG KONG, LTD.

E&MJ NEW PRODUCT DIGEST



Foamed Silica Refractory Developed (1)

Pittsburgh Corning Corp. has developed a foamed silica insulating, acid-resistant refractory material called Foamsil. So effective is the material that a 2-in.-thick block was held against the cheek of a Corning official while an oxy-acetylene torch played a 6,000 deg F flame against the other side. Material is very lightweight, has great structural strength, and can be cut with a knife or a saw. Foamsil resists thermal shock within the range of minus 450 to 2200 deg F. Material is 99% pure silica and can neither oxidize nor absorb moisture. Insulating value of Foamsil is equal to 18 inches of acid brick at 250 deg F.

Dump Truck Moves 165-Ton Loads (2)

According to *Construction Methods & Equipment*, Western Contracting Corp., Sioux City, Iowa, recently put the world's largest dump truck into use—a 35-yd Euclid end dump truck with the dump stripped off and a new 165-ton dump added, plus four more axles. Unit will haul full load at top speed of 35 mph. Engines are 375-hp Cummins diesels. Photo, courtesy International Nickel Co. *Inco*.

Waterproof Field Notebooks (4)

J. L. Darling Corp. has developed waterproof field notebooks, papers and labels for all kinds of field work. Products are being marketed under the Rite-in-the-Rain label. Pencil smears wash off easily.

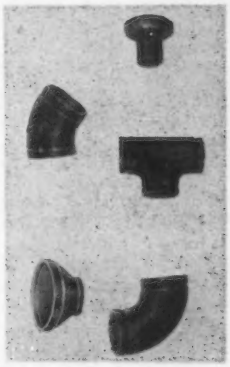
Ultrasonic Cleaner For Fine Mesh Cloth (8)

Sifting screens (325 mesh) are now being cleaned by dipping them into a SonBlaster tank containing water and detergent. In one minute, the screens which are up to 80% clogged, are virtually 100% clear. And with no damage to the cloth. No more brushing; no more chemical cleaning. According to the Narda Ultrasonics Corp., the submolecular bubbles created by the ultrasonic device attached to the tank collapse with tremendous force and literally blast the contaminants from the screen openings. Ultrasonic tanks up to 150-gal capacity are available.

Down-The-Hole Drill (3)

Torkhammer is a rotary down-the-hole machine developed by Junction Bit & Tool Co. that uses standard tricone bits. Torkhammer, according to Jack Robison, is available in 2-, 3- and 4-in. sizes for rotary bits from 4½ to 9 in. dia. According to tests, the Torkhammer has shown twice the penetration speeds of a rotary rig. Torkhammer operates on from 50 to 100 psi air and air volume of 600 to 1,000 cfm, depending on hammer and hole size. Hammer action stops as soon as thrust is removed.

Correction



E&MJ regrets the error that left Victaulic Company of America out of our Pre-Show coverage of the September American Mining Congress show. Victaulic will be at Booth No. 1622—just across the aisle from *E&MJ*. Victaulic will feature the world-famous Victaulic method of piping, showing standard Style 77 couplings; the new, speedy Snap-Joint coupling; Vic-Groove portable grooving tools; Full-Flow fittings; Roust-A-Bout couplings (sizes to 12 in. for plain end pipe). Full-Flow fittings, shown at the right above in the Plastisol design, are lined with corrosion resistant polyvinylchloride. Plastic is seamless and overlaps the edges to form a plastic-to-rubber seal with the coupling gasket.

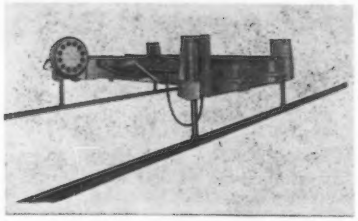
Joy To Make Carpco Statics For Iron Country Sales

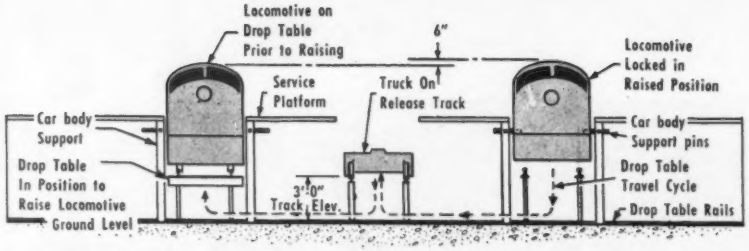
Carpco Research & Engineering, Inc. has licensed Joy Mfg. Co. as a manufacturer and distributor of Carpco High-Tension separators for the Iron Country. Joy will handle sales and production problems created by Carpco's revolutionary process for nonmagnetic iron ore (see *E&MJ*, January 1958, p 88).

Correction

E&MJ created some confusion in January NPD by saying that Ledeen Inc. makes valves. This is not correct. Actually, Ledeen Inc. makes valve actuators that mount on plug valves, to control air, gas, oil or water at up to 200 psi. Plug valve actuators may be manually or remote-control operated, according to the company.

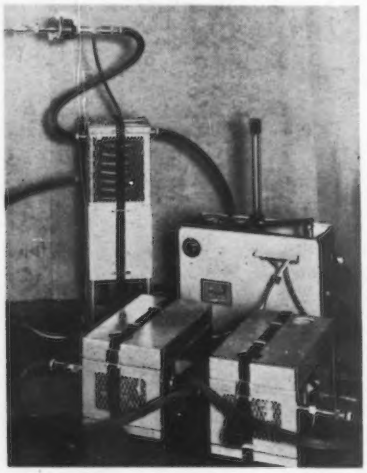
For more information on new products and for copies of the literature circle the proper number on the New Products reply card, give your name and address, and mail card to *E&MJ*.





Drop Tables to Service Diesel Locomotives Eliminates Deep Repair Pits (7)

Manning, Maxwell & Moore Inc. says that their new Shaw Box hydraulic drop tables eliminate the disadvantages of deep pit installations for locomotive repair pits, and can halve the cost of drop table installations. Table and a line drawing of the unit in use are shown. Locomotive at the right has been raised 6 in., car body supports inserted in the pit walls, and the trucks removed. Locomotive at the left is being raised by the drop table.



Dust Sampler (9)

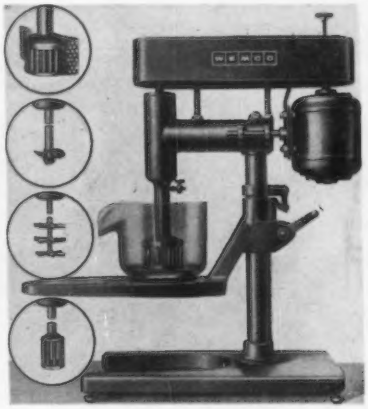
The British Iron & Steel Research Association has developed an advanced gas and dust sampling system which is now being marketed by Longworth Scientific Instrument Co. Ltd. Longworth Isokinetic Sampling Apparatus is robust, flexible and rapid. It can be used to check dust, grit and fume emission, and as a process control tool as well. Sampler has sample probe, pitot tube, filter, cooling coil, pumps and control unit.

Helicopter Surveys (13)

Fairchild Aerial Surveys, Inc. recently signed an agreement for the exclusive use of the American Metal Climax, Inc. helicopter electromagnetic system (HEM). HEM equipment is available for use anywhere that a helicopter can be obtained. HEM equipment can be air freighted on short notice to any point.

Excellent Drafting Medium (11)

Eugene Dietzgen Co. sent us a sample of their lightweight drafting film named Ageproof Film, a Mylar base plastic. We put it through some tests and they're right—it is tough and permanent. It won't tear. You can erase clean. It won't crack where folded or bent sharply. The wrinkles smooth out rather well. It's transparent, fungi-resistant, impervious to perspiration, water and even soft drinks, says the company. It's available in rolls or sheets cut to order.



Lab Flotation Cell (10)

Mineral Master developed by Western Machinery Co. is a batch type Fagergren machine with interchangeable parts to do flotation, agitation and attrition laboratory research. All major castings are now made of aluminum. Agitators and impellers are stainless steel. Air inlet has been re-designed to handle gases other than air.

High Velocity Gelatin (14)

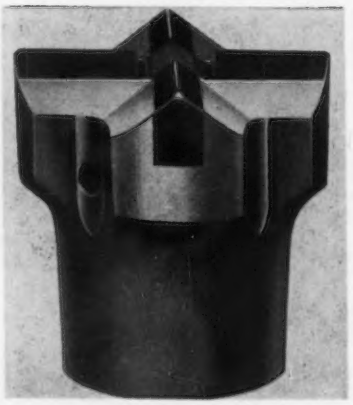
American Cyanamid Co. is introducing CX-311 Primer for low cost blasting agents of the free-running types. CX-311 cartridge is 2½ in. in dia and 6 in. in length. It has a 5 in. sleeve of Prima tube attached the length of the cartridge to facilitate loading—the primer slides along the Primacord.

Detonating Fuse (15)

A 175-grain fuse approximately ⅜ in. in dia that is said to improve the performance of ammonium nitrate blasting agents by increasing their rate of detonation, has been developed by Austin Powder Co. Coating is waterproof polyethylene that won't chip, peel or crack. Fuse is insensitive to shock, abrasion and stray currents. It can be detonated only with fuse and cap, or electric caps.

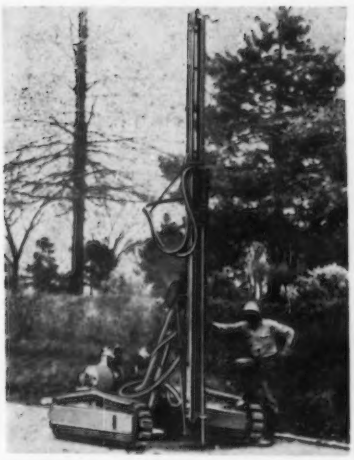
Magnetometer (12)

Varian's nuclear precession magnetometer will be used by Spartan Air Service in Canada and abroad, according to reports. Newly designed instrument puts the results on a punched tape, which can be fed to an electronic brain at the base camp.



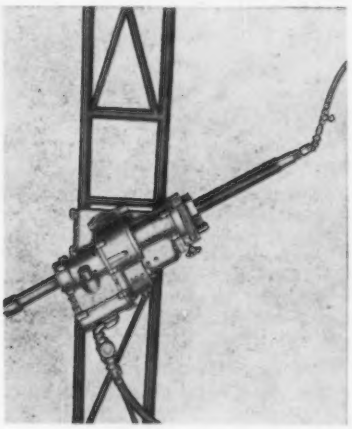
Rock Bit (16)

In rock formations where better clearance is needed and where bit extraction is difficult, Brunner & Lay, Inc. suggests that you try their cutaway carbide Rok-Bit which has self-clearing chip channels and fast cutaway wings, and is available in sizes from 1½ through 4 in.



Heavy Duty Drifter (17)

A new heavy duty 4-in. Blue Brute drifter with standard, neutral and reverse rotation has been announced by Worthington Corp. New drill is interchangeable with Worthington wagon drills, Port-A-Tracs and hydraulic booms.



Diamond Core-Blastholer (18)

Joy Mfg. Co. announces a diamond core and blasthole drill designed to operate at full motor power over a wide range of relatively low bit revolutions for extremely high torque. Joy 25 Drill uses a 14 hp rotary air motor, and is depth-rated to 500 ft with AX and to 625 ft with EX holes. Feed screw will accommodate up to AWX core barrels or AW rods.

Rotary Blastholer (19)

Heavy duty combination air blast and mud fluid rotary drill is available from Davey Compressor Co. Model M-7WA has rated capacity in excess of 3,500 ft with 2⅞ in. pipe and 2,500 ft with 3½ in. pipe. Compressor delivers 600 cfm at 100 psi.

Earthmovers of All Kinds

Pivoting seat on the Koehring Co. 10-yd Model 100 Dumptor permits the operator to drive in either direction without having to turn the dumper around. Speeds up to 20 mph are possible because of constant mesh transmission and torque converter drive. **(20)**

Dempster Brothers Inc. says that their Dempster Dinosaur for over-the-road use is available in two models—11- and 15-ton capacity. Off-the-road models will soon be available with load capacity limited only by the hoisting capacity of the unit. Major advantage of the Dinosaur design is that with a spare skip, one loaded skip can be hauled while the other is being filled. A system of hooks and hydraulic cylinders is employed to attach and detach the skip. **(21)**

Both horsepower and yardage have been increased on the LeTourneau-Westinghouse Model B Tournapull. Horsepower is now 335. Capacity is 21 yd (struck). **(22)**

Euclid Div., General Motors Corp. announces an increase in the struck capacity of Model S-18 bowl scraper from 18 to 21 yd. **(23)**

Manitowoc Engineering Corp. has added a 1½-yd shovel (crawler) to the company line. Model 2300 can be converted to 1½-yd clamshell or hoe, 1½- to 2½ yd dragline, or 35-ton crane. **(24)**

Ford industrial gasoline or diesel engines are available as engine assemblies or complete power units in either open or closed, skid-mounted models. Ford recently added three new gasoline and one diesel sizes so that the line comprises ten models from 134 to 534 cubic in. displacement. **(25)**

For hard to handle materials—Strayer Co. has added grabs, grapples and orange peel buckets to their material handling line. Check here for designs and sizes. **(26)**

Earthmover Aids

Track shoe, which has the quality to become work-hardened under use, is now available from Caterpillar Tractor Co. for Cats D8 and D9. New shoes are high manganese steel (12 to 14% Mn) and are available in 22 and 27 in. widths. **(27)**

Hydraulically-operated side booms for small crawler tractors are available from Midwestern Mfg. Co. Latest model will attach to a Case Terratrac Model 600 crawler and will handle up to 12-in. pipe with a lifting capacity of 10,000 lb. **(28)**

Track pin press that enables maintenance men to replace track pins and bushing on small tractor crawlers without removing the track shoes is now available from Owatonna Tool Co. Can be set up to handle and repair tractors similar to John Deere 40C or J. I. Case Models 200, 300, 400, and 600. **(29)**

Truck Tires (30)

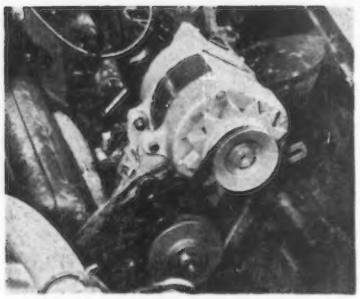
Two puncture-resistant, criss-crossed steel cord breaker strips are locked firmly in place beneath the tread by a specially compounded rubber in Steel Guard Industrial tires introduced by Goodyear Tire & Rubber Co. Available in these sizes: 4.80/400-8 6-ply in Super Rib design; and in the Industrial Lug design sizes are 6.00-9, 10-ply; 6.50-10, 10-ply; 7.50-15, 10-ply; 7.00-12, 12-ply; and 7.50-10, 12-ply.

Truck Tires (31)

Designed for mining and excavating equipment, Goodyear Tire & Rubber Co.'s Hard Rock Lug Xtra Tred design is made with nylon cord and beefed up with 30% more rubber by weight in the tread. Sizes available are 14.00-24 to 18.00-33 in tube type; and 14.00-25 to 18.00-25 in tubeless.

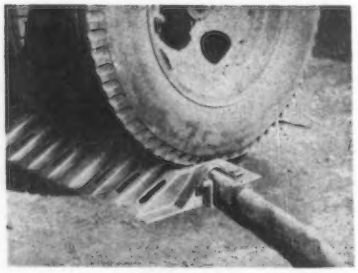
Truck Tires (32)

Nylon Steel Guard design available from Goodyear Tire & Rubber Co. combines both the advantages of nylon and the steel cord breaker strips above. Sizes available are—Road Lug design, 8.25-20 through 12.00-24; Hard Rock Steel Guard Nylon design, 11.00-22 Lug 14; 12.00-24; Lug 16; and 12.00-24, Rib 16.



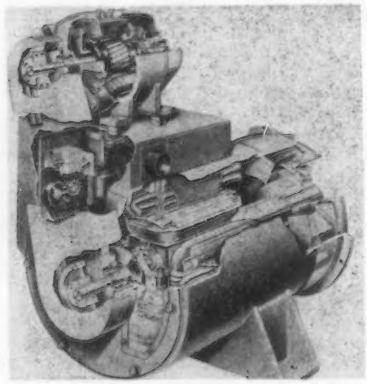
Mounted Generator (33)

Model DSD 1,000-w, 115-v ac generator is a small compact unit that can be easily mounted to a vehicle truck or car engine. Controls mount on the dashboard, says Electric Controls, Inc.



Hose and Cable Bridge (34)

Interlocking steel castings, weighing 32 lb each, that connect to any desired length, can be used to guard air, gas, water and electric hoses and lines in the mine or pit, according to Calument Steel Castings Corp.



Diesel Generator Set (35)

Caterpillar Tractor Co. has added another diesel engine generator set to the company line—the D311 Series H—with a 4-cycle natural aspirating, valve-in-head diesel connected to a 30-kw self-regulating generator. Engine has continuous rating at 2,000 rpm of 50 hp. Generator for the new engine is shown above in cutaway.

Gasoline Power Unit (36)

Heavy duty Jeep 6-cylinder engines are the power units packaged by Willys Motors Inc. in skid-mounted units housed in sheet metal. Jeep engine has maximum brake horsepower of 92 at 4,000 rpm and 82 hp at 2,600 rpm.

Battery Chargers (37)

Four shapes and 25 different electrical arrangements are possible with Exide Industrial Div., Electric Storage Battery Co.'s new, compact battery charger. Unit is designed for industrial truck batteries in the 6- to 18-cell range.

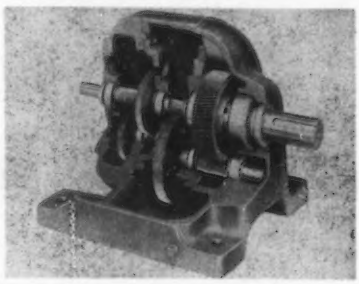
Non-Slip Material (38)

Non-slip material with a granular surface has been announced by Minnesota Mining & Mfg. Co. Scotch Tred comes in beige, black or gray colors (in rolls or tiles), and can be used as a pulley facing as well as a floor covering. Free sample available. Adhesive-coated back is pressure sensitive.

Motor Starting Fluid (39)

Super hot formula SureFire motor starting fluid is now available in 11-oz aerosol-type containers, as well as in pint cans. Fluid will start gasoline or diesel engines down to minus 65 deg F. Fluid is corrosion inhibited and contains a lubricant to prevent dry starts.

Motors and Drives



Quadruple reduction helical gear drive and new larger sizes of double and triple reduction drives have been added to Link-Belt Co. line. Drives with capacities of more than 200 hp are now available. **(40)**

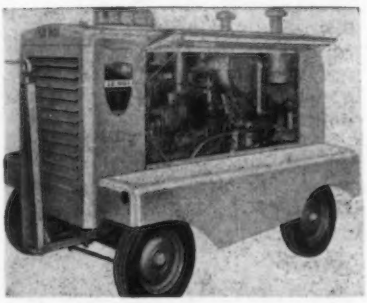
Screw conveyor drive that is simple to mount and adjust on standard conveyor troughs is the newest addition to Dodge Mfg. Corp. line, according to the company. Four sizes available, each in two ratios (18:1 and 8:1). **(41)**

Flange-mounted drive bolts directly to the driven machine and has been designed with bearing capacities for overhung and thrust loads to allow installation into the driven machine as a geared pillow block, if desired, says Falk Corp. Available in single reduction for ½ to 10 hp; and in double for ½ to 5 hp. Information on larger horsepower applications may be had by writing to the company. **(42)**

Three large sizes and one small size for low horsepower applications have been added to Flexidyne dry fluid drives and couplings, according to Dodge Mfg. Corp. Sizes now range from ¼ to over 1,000 hp. Largest of the new units is a 27-in. coupling, 27CK, with horsepower rated at up to 1,000 at 900 rpm. An 18-in. dia Flexidyne is now available for V-belt drive or as a direct shaft-to-shaft coupling. Model 18CK will deliver up to 200 hp at 1,200 rpm. **(47)**

Belt Conveyor (43)

Hammock-style idlers suspended on wire ropes which can be suspended from conveyor stands or from a mine roof are one feature of Hewitt-Robins, Inc. new belt conveyor. The conveyor is made up of steel stands of uniform size and shape. The belt travels on hinged idler rolls mounted in the hammock-shape frame.



Low Speed Compressor (44)

Rotary air compressor (100 psi, 365 cfm) with a compressor speed of only 1100 rpm is available from Le Roi Div., Westinghouse Air Brake Co. Model 365RD2 is the second of a new line. It is portable, two-stage, oil-cooled and sliding-vane type. Compressor couples to a GM 471 diesel running at 1650 rpm.

Portable Cable Skids (45)

Portable mining cable skids that serve as portable switching stations for ac distribution have been announced by General Electric Co. For use on surface or underground, the skids are available for use on systems rated 4.16 kv to 7.2 kv, with short circuit capacity from 25 to 150 mva.

Vertical Motor (46)

Weather-protected vertical motor, intended for outdoor operation under all weather conditions, meets NEMA Type II weather-protected specifications, according to Louis Allis Co. It is manufactured in 250 to 2,000 hp sizes in both hollow and solid shaft construction.

Neoprene V-Belts (48)

Boston Woven Hose & Rubber Co. has shifted its entire production of industrial V-belts to a new construction of neoprene reinforced with dacron polyester fiber. Abuse and abrasion resistance, greater longitudinal flexibility and transverse strength rigidity are stated as advantages.

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Earthmovers

CAPABILITIES of large crawler tractors are given in Caterpillar Tractor Co.'s 12-page booklet "Increase Power, Production, Profit". **(61)**

EARTHMOVERS in the Euclid Division, General Motors Corp. line are illustrated in a brochure now available. **(62)**

"HIDDEN ELEMENTS", a booklet prepared by Caterpillar Tractor Co., describes the many tasks that Cat machinery can perform around a mine. **(63)**

TRACTOR DOZER catalog available from Construction Machinery Division, Clark Equipment Co., is 20 pages long, and describes the Michigan Models 180, 280 and 380. **(64)**

SINGLE-STICK, semi-automatic Fuller Roadranger transmissions are illustrated in Fuller Mfg. Co. literature. 10pp. **(65)**

Mining

ALL-PURPOSE earth auger, the Acker Drill Co., Inc.'s Model AP, is suitable for soil sampling, coring and general purpose prospecting and augering, according to latest bulletin. 8pp **(66)**

CONTINUOUS BORER mining machine—Type 425 by Goodman Mfg. Co.—is presented in a well-illustrated 4-page bulletin. (G-136). **(67)**

PROTECTIVE CLOTHING available from B. F. Goodrich is presented in catalog (12000). 8pp. **(68)**

Engineering Office

ELAPSED TIME COMPUTER, the Calculagraph developed by Calculagraph Co., is a simple, accurate, fast way to make automatic time studies. 4pp. **(60)**

Motors and Power Transmissions

IMPERVIOUS insulation system used for motor and generator stator coils by Allis-Chalmers Mfg. Co. is illustrated in a 6-page bulletin on Silco-Flex (05B8341A) **(69)**

HOW TO SELECT gear motors and in-line speed reducers is the purpose of Philadelphia Gear Works, Inc. bulletin on G size Gearmotors. 4pp. **(70)**

FRACTIONAL and integral horsepower motors from 1/20 to 200 hp are illustrated in Marathon Electric Mfg. Corp. 4-page condensed catalog. **(71)**

VERTICAL SYNCROGEAR agitator drives are introduced in U. S. Electric Motors, Inc.'s 4-page bulletin. **(72)**

ALTERNATORS in the 60 to 400 kw range are described in Kato Engineering Co. literature. **(73)**

SMALL MOTORS, rated at 1/20 hp at 2900 rpm in the new ac shaded pole motor design, are illustrated in a catalog available from Barber-Coleman Co. **(74)**

WORM GEAR drive bulletin (150) from Cleveland Worm & Gear Co. is 8 pages long. **(75)**

SHAFT-MOUNTED SPEED REDUCERS booklet from Westinghouse Electric Corp. discusses selection, rating, construction, installation and maintenance of the Moduline speed reducers in 10 pages. **(76)**

ROLLER CHAIN DRIVES in Maurey Mfg. Corp. line are described in an 8-page catalog (D-58). **(77)**

FLEXIBLE DRIVE COUPLING catalog on the Magnaloy line of couplings (3/8 to 6 inches) says that these couplings are in two designs and made of magnesium alloy. 4pp. **(78)**

V*S DRIVES control, change and regulate drive motor speed, horsepower and torque through a wide range of changes, according to a well-illustrated, 4-color bulletin from Reliance Electric & Engineering Co. 16pp. **(79)**

Maintenance and Electrical

COMPLETE LINE of Blue M Electric Co.'s ovens, furnaces, baths and temperature control equipment are illustrated in a 200-page catalog (158). **(80)**

PRECISION steel roller chains and sprockets from Link-Belt Co. are presented in a comprehensive 154-page bulletin (book 2657). **(81)**

TIMBER FRAMING ANCHORS design data and uses are presented in

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1	17	33	49	65	81	97
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7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
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9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
15	31	47	63	79	95	111
16	32	48	64	80	96	112

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Title .....

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

Timber Engineering Co. bulletin on Du-al-clip anchors. 4pp. **(82)**

CORROSION-PROOF TANKS lined with either branch or linear polyethylene or polypropylene are illustrated in literature available from American Agile Corp. **(83)**

ROTARY POSITIVE GAS PUMPS are illustrated in Roots-Connersville Blower Division, Dresser Industries, Inc. bulletin (XA-458). 6pp. **(84)**

CYCLOIDAL BLOWERS for vacuum service are illustrated in Roots-Connersville Division bulletin (VP-158). 13pp. **(85)**

COMPRESSORS in the Roots-Connersville Spiraxial (R) line, for service from 1,000 to 12,000 cfm at up to 15 psi are illustrated in bulletin (LAH-158). 4pp. **(86)**

ROTARY POSITIVE BLOWERS, Type RAS by Roots-Connersville, are available in 36 sizes from 2,000 to 14,000 cfm at pressures up to 6 psi, and from 1,500 to 8,000 cfm at pressures up to 10 psi. Bulletin RAS-158. 4pp. **(87)**

INDUSTRIAL TOOL CATALOG, 156-page buying guide for purchasing agents, engineers is available from Snap-On Tools Corp. **(88)**

PLASTIC STEEL, a maintenance product that will repair machine castings and parts for further use is described in literature available from Devcon Corp. Company also makes a plastic aluminum. **(89)**

LUBRICANTS in the Lubriplate line, ranging from light oils to heavy greases, are discussed in Fiske Brothers Refining Co. literature. **(90)**

LUBRICANTS from Keystone Lubricating Co. are characterized in a 20-page bulletin (BK-19-A). **(91)**

CENTRIFUGAL, ventilator, exhauster and axial airfoil fans from Chicago Blower Corp. are presented in a 4-page folder. **(92)**

SEMI-AUTOMATIC welder available from Wall Colmonoy Corp. is described in a 2-page flier. Tube wire is also considered. **(93)**

BARE STAINLESS STEEL welding wire and an expanded line of manual and automatic hard surfacing electrodes are announced in Welding Products Div., A. O. Smith Corp. literature. 12pp. **(94)**

FLAME CUTTING EQUIPMENT in the Oxweld line from Linde Co. is detailed in a 6-page folder. **(95)**

SLINGS AND FITTING offered by Union Wire Rope Corp. are discussed in a 40-page booklet. **(96)**

INDUSTRIAL SIGNALS and markers that use radioisotope excited light are presented in U.S. Radium Corp. literature. 4pp. **(97)**

BIG CABLES engineered for mining is the title of Bronco 66 bulletin available from Western Insulated Wire Co. 6pp. **(98)**

COMPLETE LINE of Nordberg Mfg. Co. 4-cycle V-type engines in 12 or 16 cylinder diesel design are featured in literature now available. 17pp. **(99)**

DESIGN and construction of Allis-Chalmers Mfg. Co. steam turbine-generating units rated 2,000 through 16,500 kw are covered in a 40-page bulletin (2722) on WA Series turbine-generators. **(100)**

THERMOPRUF chains which provide up to 33⅓% more heat transfer surface (for wet process cement, lime sludge kilns, wash mills, etc.) are illustrated in bulletin (2767) from Allis-Chalmers Mfg. Co. 88pp. **(101)**

HIGH VOLTAGE air-break contactors, Type 256A from Allis-Chalmers Mfg. Co. for maintenance-free switching applications to 5,000v, are presented in bulletin 14B7303B. 6pp. **(102)**

REFERENCE PRIMER on the field of 2-way radio communication has been prepared by Motorola Inc. Communications & Industrial Electronics Division. 19pp. **(103)**

BALL BEARING trolleys engineered by Link-Belt Co. are presented in a 20-page bulletin (book 2636). **(104)**

CORROSION-RESISTANT COATINGS from Wisconsin Protective Coating Co. are tabulated in a 4-page bulletin. (258). **(105)**

ELECTRIC FURNACE quality steel products in A. M. Byers Co.'s Ambalalloy line are discussed in 6-page bulletin. **(106)**

DIVERSIFIED PRODUCTS offered by Fischer & Porter Co. are presented in a 24-page bulletin. Company makes flowmeters, process instrumentation, and glass products. **(107)**

HOW MIDVALE-HEPPENSTALL CO. produces custom steel for industry is the subject of a 34-page piece prepared by the company. **(108)**

THERMAL EXPANSION and how to allow for it in refractory linings is the feature article in *Refractories by Carborundum,* Vol 3., No. 3, July 1958. **(109)**

SAFETY AND HEALTH OF WORKERS is the title of a booklet prepared by the International Labor Organization, which describes the ILO's work in the many regions of worker safety. 40pp. Write direct to ILO, 917 Fifteenth St., N. W., Washington, D. C. or to Geneva, Switzerland.

In secondary blasting, it's a lot better to hook-up and ignite your safety fuse with Quarrycord

Prime with safety fuse and blasting caps. You'll play-it-safe two ways:

- No danger from stray electrical currents or thunderstorms.
- No big "boom!": you get a series of small shots: "pop-pop-pop".

Connect and ignite your safety fuse primers with Quarrycord and play-it-safe *again* because—

- No men on the rock pile. The entire blast is set off by *one* man at a point where escape is safe and easy.

Quarrycord is packed on spools in 100-ft. lengths. It is easily lighted with a match and burns with a very hot open flame at the rate of about one foot per second.

HOW TO USE QUARRYCORD

Cut your safety fuse in equal lengths as prescribed by your State law, and prepare your primer cartridges. On the end of the fuse opposite the blasting cap place a Connector. This is a metal tube containing an ignition compound in the slotted end, and color-banded for easy identification. Load and tamp the holes.

When ready to blast, connect all holes with Quarrycord, placing it in the slot of each Connector and pressing the "lid" down to hold the Quarrycord firmly in place and assist ignition.

Connect your main lines with cross lines wherever these will cut down the over-all burning time. Lead main lines off to a point away from the rock pile. When all is ready, light this end with a match and go to a place of safety.

Q-5

It's quite a story, told completely in this folder which we'll send you, free, when you ask for it. Write today.

Your explosives supplier can supply Quarrycord and Connectors.

THE ENSIGN-BICKFORD COMPANY

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Primacord® and Detacord® Detonating Fuse, Safety Fuse, Ignitacord®, Quarrycord®, Pyrotechnical Devices and Blasting Accessories

Pamak, Hercules Distilled Tall Oil Fatty Acids, offers a low-cost, dependable source of high-quality Oleic-linoleic Acids for flotation

Pamak is now being used successfully as a collector in the beneficiation of such minerals as barytes, feldspar, fluorspar, hematite, hydrous magnesium oxide ores, kyanite, phosphate rock, and spodumene.

Hercules' flotation laboratory and field service are at your disposal to determine how Pamak, the low-cost, dependable, high-quality collector, can benefit you. Write for further information.

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PT58-4

It will pay you to investigate these 3 ADVANCED FEATURES in the CASE W-9

A free demonstration will quickly convince you that the Case W-9 Terraload'r has all the money-making features found in the most modern 4-wheel-drive loaders — PLUS *three major advances* that enable it to outperform competitive loaders costing up to $1000 more. Here are the facts, which we'll gladly *prove* anywhere, anytime:

Advanced Feature No. 1 — Better balance and stability.

You won't find this feature in the specifications — BUT the minute you get behind the wheel of a W-9, *you'll know what we mean.* There's no bucking or raising rear wheels off the ground when loading . . . less tendency to dip forward or sway sideways when traveling or dumping. Result: you move more material, in less time, with greater safety.

Advanced Feature No. 2 — Better power-weight-torque-ratio.

Five minutes of operation will convince you that the 1¾-cu. yd. W-9 has just the *right combination* of engine power, torque ratio and machine weight — to provide maximum traction and break-out, with *minimum wheel slippage.* Result: higher daily output, lower costs for fuel and maintenance.

Advanced Feature No. 3 — Greater safety for operator.

Note that booms and cylinders on the W-9 *never pass the operator's compartment.* Result: operator has unobstructed visibility in all directions . . . can easily get on or off machine anytime . . . never needs to worry about catching arm in lifting mechanism.

CASE

1st in quality for over 100 years

Like all Case Industrial wheel and crawler units, the W-9 Terraload'r is sold and serviced by reliable Case Industrial Dealers everywhere . . . is available on lease or easy monthly terms, with seasonal "skip-payment" privileges. Check today!

CERTIFIED OWNER REPORTS

Read what these three Pit operators say:

"Best machine we've ever used"

"We like the Case W-9 Terraload'r better than any rubber-tired rig we've ever had on our job. We've found it extremely fast, easy to handle and easy on fuel. Dealer service is excellent and the price saving of around $2000 — compared with the second best machine we tried — is like frosting on the cake."

Denny-Simpson Stone Co.
Harrisburg, Ill.

"Replaced two power shovels"

"The W-9 replaced two more expensive shovels and not only speeded up our truck-loading operation, but cut maintenance and operating cost. It's geared for greater speed and moves around the pit fast. Visibility is especially good."

William B. Taylor
W. B. Taylor Sand & Gravel Co.
Sharon, Pa.

"Doubled our production"

"We bought a W-9 to speed up our operation and cut down on help — and have found it is the best machine for the varied work we do. It strips overburden, stockpiles, loads trucks, and cleans up around the crusher. Our W-9 has increased our production 100%."

Herman Leukhardt
Leukhardt Supply Co.
Greenville, Pa.

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Racine, Wisconsin, U. S. A.

☐ Send free illustrated catalog and specifications on the W-9 Terraload'r

☐ I'd like to see a free demonstration on my job

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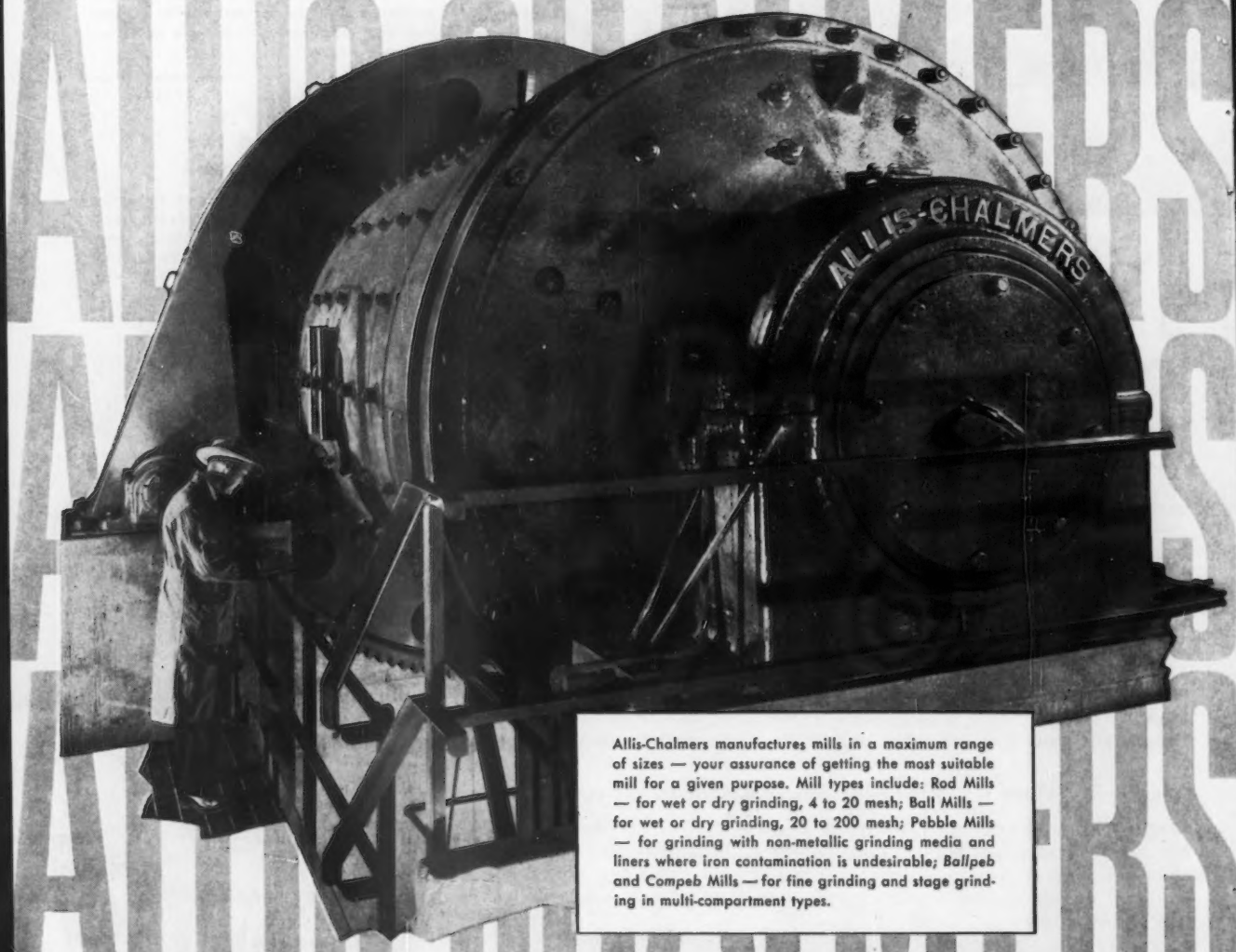
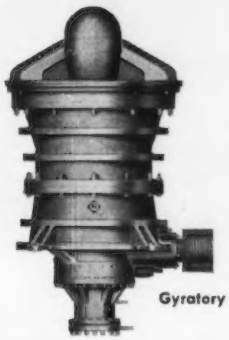
ALLIS-CHALMERS

Specialized Equipment for the Mining Industry

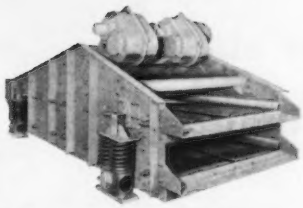


Allis-Chalmers manufactures mills in a maximum range of sizes — your assurance of getting the most suitable mill for a given purpose. Mill types include: Rod Mills — for wet or dry grinding, 4 to 20 mesh; Ball Mills — for wet or dry grinding, 20 to 200 mesh; Pebble Mills — for grinding with non-metallic grinding media and liners where iron contamination is undesirable; *Ballpeb* and Compeb Mills — for fine grinding and stage grinding in multi-compartment types.

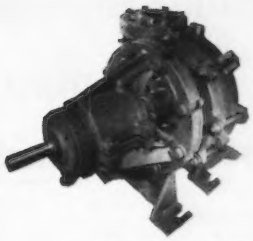
ALLIS-CHALMERS



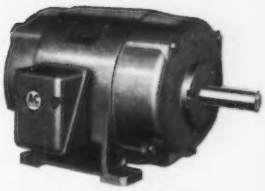
Gyratory Crushers



Screens



Rubber-Lined Pumps



Motors

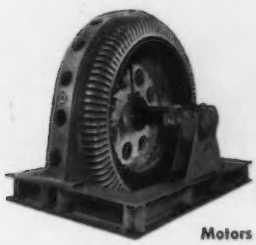
ONLY Allis-Chalmers builds processing machinery and matched electrical equipment for the mining industry

Maximum mill efficiency is the product of plant design, material flow, close coordination of all processing equipment, careful matching of processing equipment with supporting electrical equipment, power supply, maintenance. All these factors are carefully considered before Allis-Chalmers makes equipment recommendations. And *no other company* makes both mechanical and electrical equipment for the mining industry. *Only* Allis-Chalmers has the facilities and experience to apply and coordinate all equipment for a complete mill.

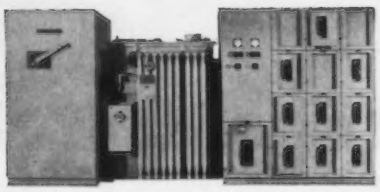
Help from a technical team. Before a recommendation is offered, a careful study of all the requirements and variables is made by an Allis-Chalmers team of research, design, manufacturing and application specialists. Where necessary, special problems are worked out in our pilot plant facilities. Finally, all information is assembled and acted on by our mining industry application department. Our resulting recommendation promises you complete plant efficiency backed by Allis-Chalmers responsibility for the entire installation.

Call your nearby Allis-Chalmers representative to arrange for a cooperative effort between A-C and you or your consultants. Or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

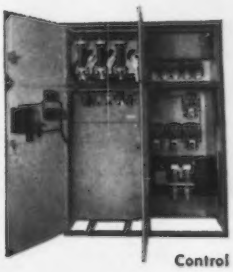
Ballpeb and Compeb are Allis-Chalmers trademarks.



Motors



Unit Substations



Control

ALLIS-CHALMERS

A-5756

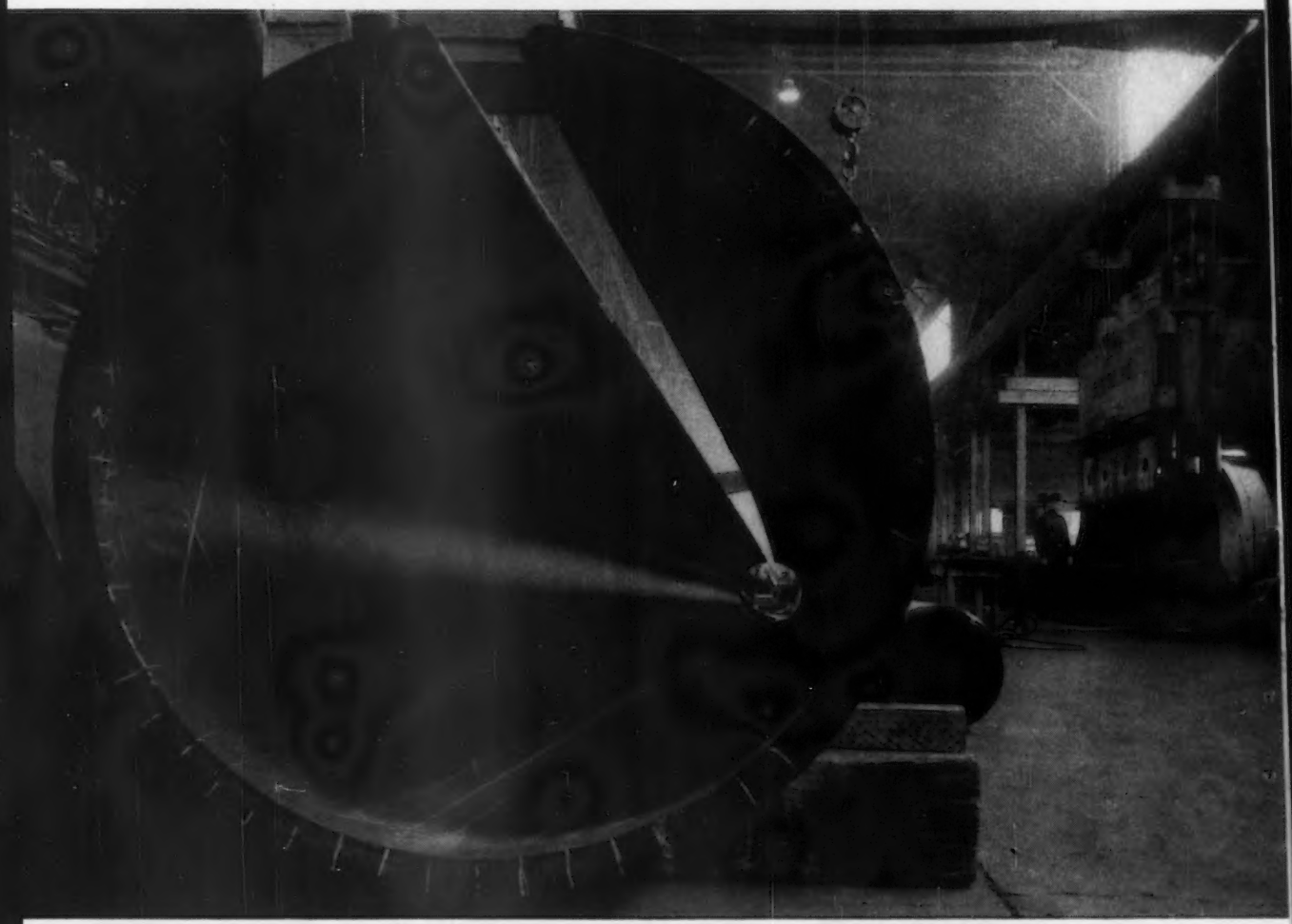
Tubular High-Strength Steel dipper stick is stronger and lighter

The picture shows a plate of High-Strength Steel that has been formed into one of the stiffest, strongest structural shapes known to man: a tube. It will become an amazingly light and tough dipper stick and permit a shovel to operate with greater cycle speed and capacity. In addition, the design and the steel combine to give it tremendous resistance to bending and shock loading, even at very low temperatures.

Both USS* TRI-TEN High-Strength Low-Alloy Steel and USS T-1*, a Constructional Alloy Steel, have been used in the most highly stressed members of many shovels—in booms, crowd members, buckets, bail assemblies and frames. They respectively offer increased yield strengths of about 1½ and 3 times that of structural carbon steel, along with good welding qualities and excellent toughness. Both steels are helping the present-day operator achieve one of his most important goals: to move more and more material at less cost.

When you invest in mining machinery that must do heavy work, specify USS TRI-TEN* or USS "T-1" Steel for faster, longer, more trouble-free operation. Your builder can give you details.

USS Tri-Ten Steel dipper handle during fabrication at National Annealing Box Co., Washington, Pa., for Bucyrus-Erie. Sizes of high-strength and alloy steel dipper sticks made here have ranged up to 40" x 77' with 1.75" wall thickness.



United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

USS *TRADEMARK

United States Steel

MORE in Performance, Safety, Design!

MANCHA STORAGE BATTERY LOCOMOTIVES

Production is beginning to roll from Canada's Blind River District Uranium mines . . . and Mancha Locomotives are providing the transportation. The Rio Tinto group (Milliken Lake, Northspan and Panel) are installing 13 Mancha TITAN ANX Locomotives. Algom Uranium has 12 Mancha TITAN BN and 3 TITAN ANX Locomotives on the job. Mine staffs of these prominent companies analyzed their haulage requirements and found Mancha offered more in every way.

MORE in Performance—power and haulage capacity, speed and maneuverability . . . economy. Mancha outstanding in all respects.

MORE in Safety—particular attention to motorman's protection. Roomy cab with high, heavy (½" thick) steel guard plate reduces possibility of accidents . . . improves production.

MORE in Design—controller, brakes, lights motor protection . . . special consideration to low maintenance, less down-time. Trackmaster design smooths uneven track and cushions battery . . . longitudinal equalizers and self-aligning journal bearings improve over-all performance. All-round extra sturdy, rigid frame construction.

MORE Information—What Mancha provides in haulage economy for others, it can provide for you. Write today.

SPECIFICATIONS:

	TITAN BN	TITAN ANX
Operating weight. . .	3.4 tons	4.5 tons
Tractive effort.	750# at 4 mph.	1200# at 4 mph.
Battery capacity. . . .	19. Kwhr	35.2 Kwhr
Length.	8′	10′
Width.	42″	46″
Height.	42″	48″

MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois •

Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.

DEPENDABLE
NAYLOR PIPE
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Whatever your piping needs—ventilating, water, air, tailings, hydraulicking—dependable NAYLOR Spiralweld pipe offers you distinct performance advantages. It's easy to handle and install. It gives you extra strength and safety. And with the one-piece NAYLOR Wedgelock coupling for connections, lines can be made up faster, more economically. Sizes from 4″ to 30″ in diameter, wall thickness from 14 to 8 gauge.

Write for Bulletin No. 507

NAYLOR PIPE *Company*

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

ENGINEER'S FIELD REPORT

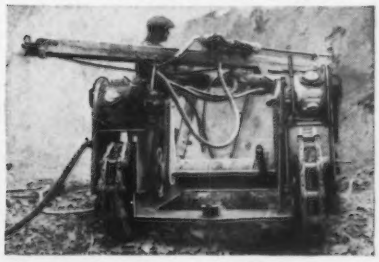
PRODUCT **CHEVRON VISTAC OIL**

FIRM **NEVADA-MASSACHUSETTS COMPANY**
Tungsten, Nevada

Special Oil holds wear to minimum for 15 yrs.

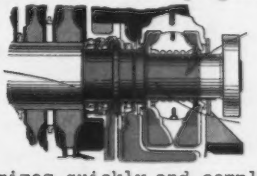
Nevada-Massachusetts Co., operators of one of the world's largest tungsten mines, has relied on Chevron Vistac Oil for 15 years, to keep their rock drills and other air tools operating at peak efficiency. "We use Vistac because it stays on the tools whether they're wet or dry. Doesn't create drag, either...we get full power with minimum tool wear," says general manager Eldridge Nash. Oil's tough, protective film resists high operating temperatures, helps this firm's rock drills (above) bore fifteen 2½-inch blasting holes averaging twelve feet in depth, in just eight hours. Nevada-Mass. does extensive underground mining at this site as well as surface operations.

Despite heavy abrasive dust from drilling in Hornfels and Scheelite, (above), Chevron Vistac Oil keeps rock drills working smoothly. Lubricant is used in 60 rock drills, 3 wagon drills, plus 25 tuggers (air motors) on hoist equipment, loaders, slusher hoists and sump pumps.



Special wagon drill, built at mine, uses Ingersoll Rand DA 35 rock drill to bore horizontal holes up to 18 ft. deep. EIMCO air motors lubricated with Chevron Vistac Oil power tracks for fast and easy maneuvering.

Why Chevron Vistac Oil cuts costs in air-tool equipment



- Atomizes quickly and completely—carries evenly over all parts. Prevents excessive fogging and has no unpleasant odor.
- Additives help form tenacious, oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss.
- Resists high temperatures and oxidation. Stays fluid at low temperatures.

For More Information on this or other petroleum products, or the name of your nearest distributor, write or call any company listed.

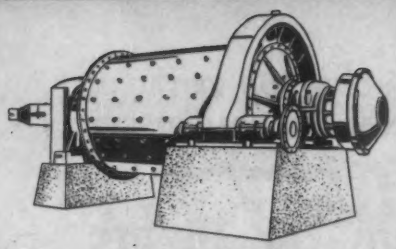
CHEVRON Industrial Lubricants

TRADEMARKS "CHEVRON," "VISTAC" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

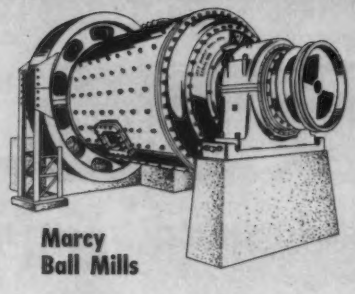
STANDARD OIL COMPANY OF CALIFORNIA,
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY,
P. O. Box 780 • Denver 1, Colorado

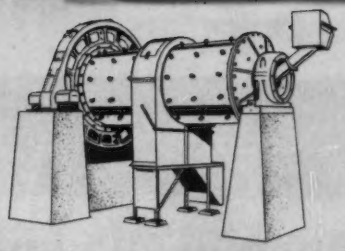
STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas



Marcy Rod Mills



Marcy
Ball Mills



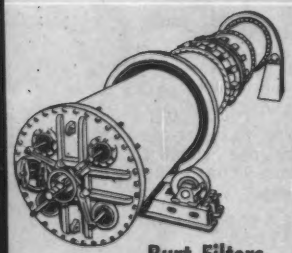
Marcy CPD Rod Mills

We've joined

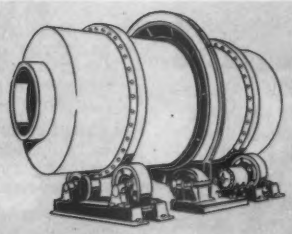
MINE AND SMELTER AND

and <u>you</u> will have

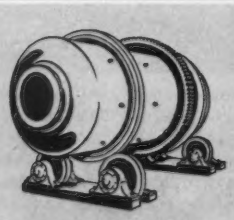
- **the advantage of the combined experience of both companies on *all* jobs.**
- **closer coordination in the application of related equipment**
- **coordinated engineering on complete product line**
- **centralized control of production**
- **convenience of one contact for all products**
- **one source of responsibility on all products**
- **extensive international sales and manufacturing facilities**



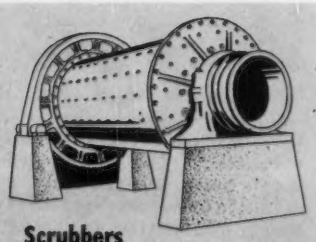
Burt Filters



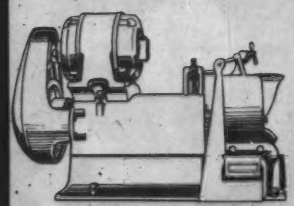
Fusion Furnaces



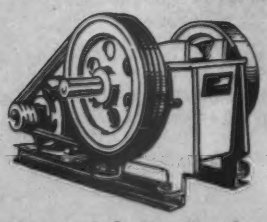
Leaching Drums



Scrubbers



Massco-McCool Pulverizer

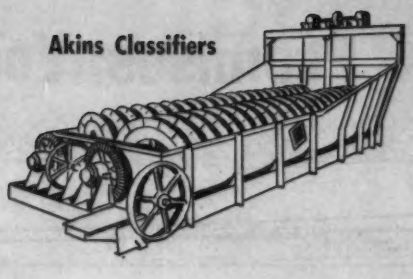


Massco Lab Jaw Crusher

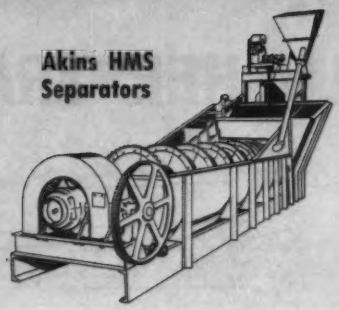
Licensed Manufacturers and Sales Agents in Canada, Australia, Sweden, England and South Africa.

Sales Agents in Chile, Philippine Islands, Japan, New York City (for Continental Europe), and in the principal cities of the United States.

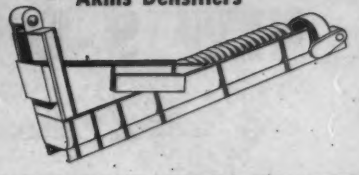
Akins Classifiers



Akins HMS Separators



Akins Densifiers



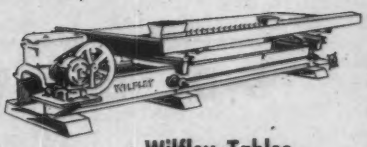
Esperanza Drag Classifiers

forces...

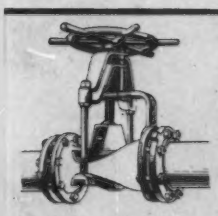
COLORADO IRON WORKS

Since 1952 Colorado Iron Works has been a subsidiary of The Mine and Smelter Supply Co. Now, the two companies have been integrated. The Manufacturing Division (formerly Marcy Mill Division) of Mine and Smelter will include the sales, engineering and production departments of both companies.

Skinner Roasters and Dryers

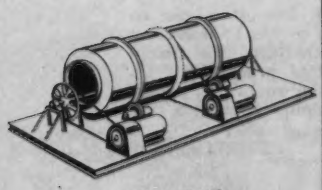


Wilfley Tables



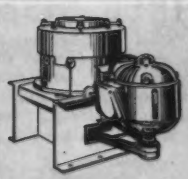
Massco-Grigsby Rubber Pinch Valves

Marcy Pulp Density Scale

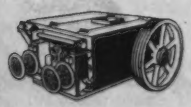


Pug Mills

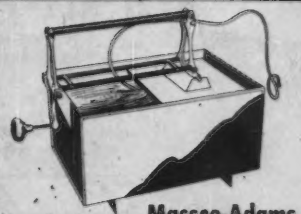
Vezin Sampler



Massco Gy-Roll Reduction Crusher



Lab Crushing Rolls



Massco-Adams Reagent Feeder

Manufacturing Division

THE MINE AND SMELTER SUPPLY CO.

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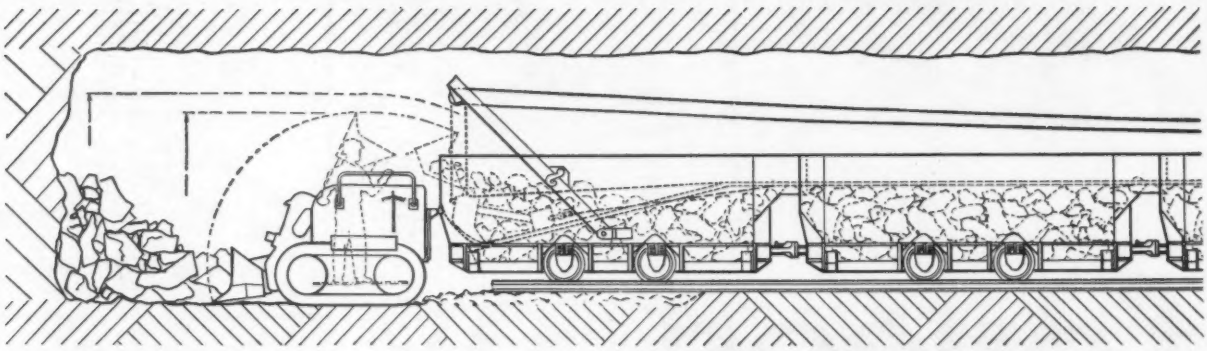
3800 RACE STREET

NEW YORK 17
122 E. 42nd STREET

SALT LAKE CITY 1
121 W. 2nd S.

EL PASO
P. O. BOX 1162

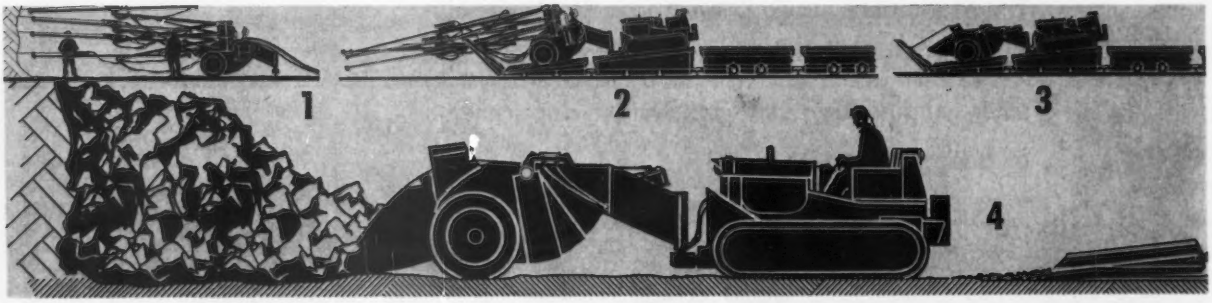
NEW S-D SLUSHER-TRAIN Promises You



"High-Ball-it" Speed and Safety Will Save You Days . . . Weeks

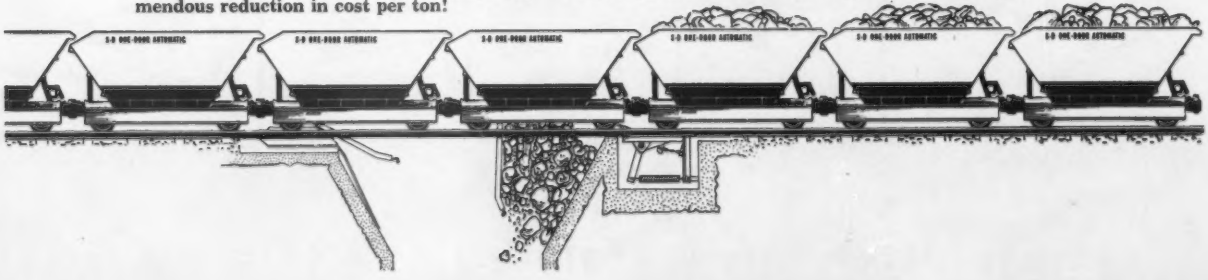
Here is what you have: (1) Equipment — Loader, S-D Slusher-Train and locomotive. (2) Men — only two . . . the loader operator and the S-D Slusher-Train operator, who becomes motorman when S-D Slusher-Train is in transit. Train is made up of S-D Automatic Bottom Dumping cars of any required number to give you the capacity to hold an entire round. Cars are not dumped until round is mucked-out and ready for next operation, drilling or timbering. There is no car switching, and no extra men required. Cars feature S-D, exclusive overlapping ends. You can figure on mucking out 1 to 1½ tons a minute. S-D Slusher-Train moves into face and remains stationary until entire round is mucked-out. Train is dumped by means of simple S-D Automatic tripping and closing devices. You obtain high speed mucking with less equipment, requiring less maintenance and fewer men. You get the muck out faster so you can start drilling again — saving days, sometimes weeks with fewer men in driving tunnels . . . obtaining tremendous savings in man-hours, maintenance and time! AND, same cars used in development can be used for production haulage!

S-D SLUSHER-TRAIN AND S-D GISMO® FEATURED

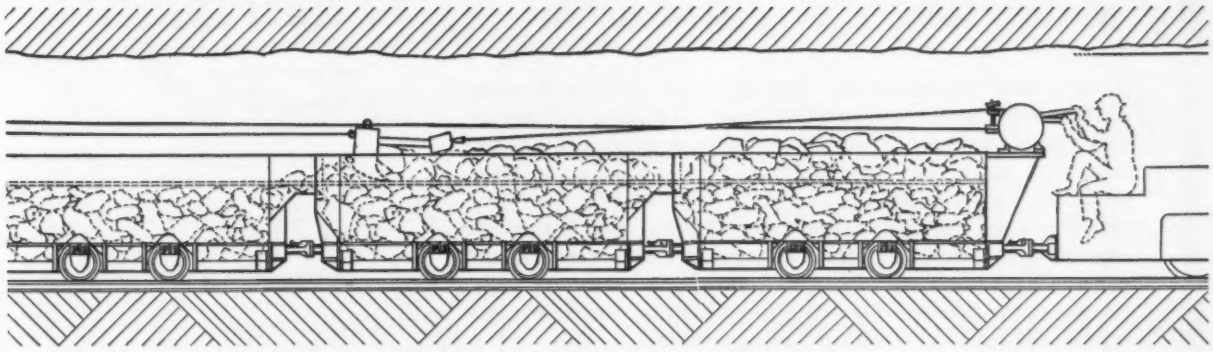


NEW ALL-PNEUMATIC-TIRED GISMO TRANSLOADER EXHIBITED

If you are attending the Mining Show at San Francisco Sept. 22-25, our Booth 840 offers you an excellent opportunity to investigate to your satisfaction the large savings available to you by operating with S-D SLUSHER-TRAINS . . . S-D GISMO . . . and new S-D GISMO TRANSLOADER. The Gismo equipment offers you a self-loading transport that loads (mucks) in development or production . . . transports . . . supports 2 to 5 job-mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a proved method of hard rock mining offering a tremendous reduction in cost per ton!



Tremendous Savings in Tunnel Driving



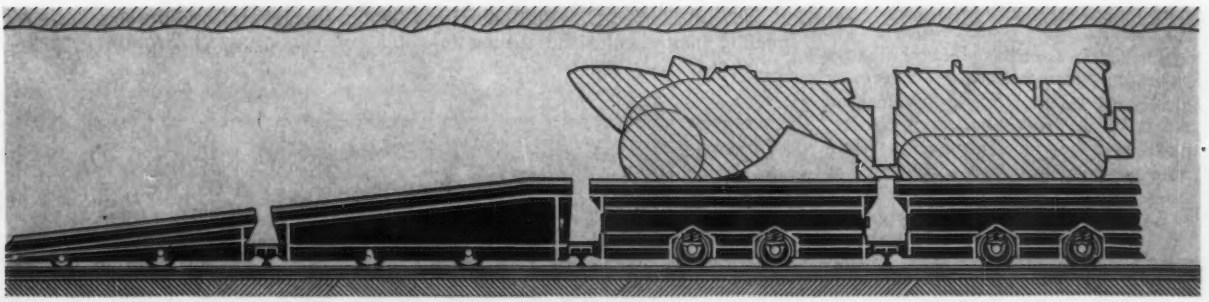
of time and Costs in Completing Jobs, based on today's Methods

The Gismo Ramp Car method is your answer to low-cost tunnel driving where larger cross sections are being driven, especially where a haulage drift is being driven in ore zone. In this way train can be loaded by the Gismo Self-Loading Transport without installation of ramp, chutes, etc. Regardless of which equipment best meets your requirements, S-D Slusher-Train, S-D Gismo or new S-D Gismo transloader the cars also become the most economical method for production haulage.

Illustrations show:

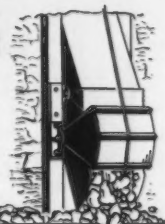
1. The Gismo Drilling Jumbo moves in to drill out a round with 4 drills operated by a two-man crew.
2. Drilling completed, Gismo Jumbo pulls out from face to ramp cars for transfer to another heading or side-track.
3. In the meantime, rock has been blasted at the previously drilled face and Gismo Self-Loading Transport is brought in for mucking and transporting operation.
4. While Gismo is mucking at the previously blasted round, loading cars one-after-another, the Drilling Jumbo can be set up at another heading in multiple heading development.

AT SAN FRANCISCO MINING SHOW SEPT. 22-25



S-D OVERLAPPING END ONE-DOOR AUTOMATIC

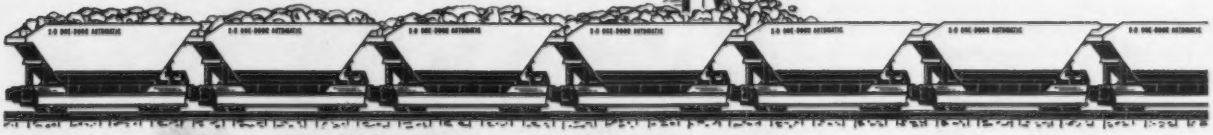
Gives you greater capacity for same overall dimensions . . . better trackability . . . low center of gravity . . . wide door opening . . . clean shedding . . . simple and low cost dump facility . . . ruggedness of design.



PREVENTS SPILLAGE

For complete information on S-D Slusher-Trains, S-D Gismo Equipment and S-D Mine Cars write us today.

Sanford-Day Iron Works, Inc.
Knoxville, Tennessee



SD SANFORD-DAY KNOXVILLE, TENNESSEE

CHEMICAL "TOOLS" *make mining industry news*

Chemical processes for cutting costs and increasing profits are constantly moving from the developmental stage into the production stage. In a relatively short time, two such processes have proved their value to mining men by the acid test of usage in the field. These new metallurgical tools—ion exchange resins and chelating agents—provide new effectiveness and economy in an area where they've long been needed. Pertinent facts on these and other Dow mining chemicals are briefed below for rapid dollars-and-cents reading.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

Route to:

_____

_____

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ION EXCHANGE YIELDS HIGH RETURNS

Many metallurgists now tackle the exacting business of recovering metal from ore with the same basic process that softens water in homes. No longer a novelty, ion exchange resins are earning their keep throughout the mining world.

The basic concept of ion exchange is not new to metallurgists—transfer of ions is the basis of many metallurgical reactions. In ion exchange processing, metals are chemically separated from pregnant solutions and concentrated as a result of such a reaction. This is accomplished by contacting tl.e pregnant solution with an exchange bed of water-insoluble ion exchange resins. Metal ions are then exchanged for ions in the resin and thus concentrated.

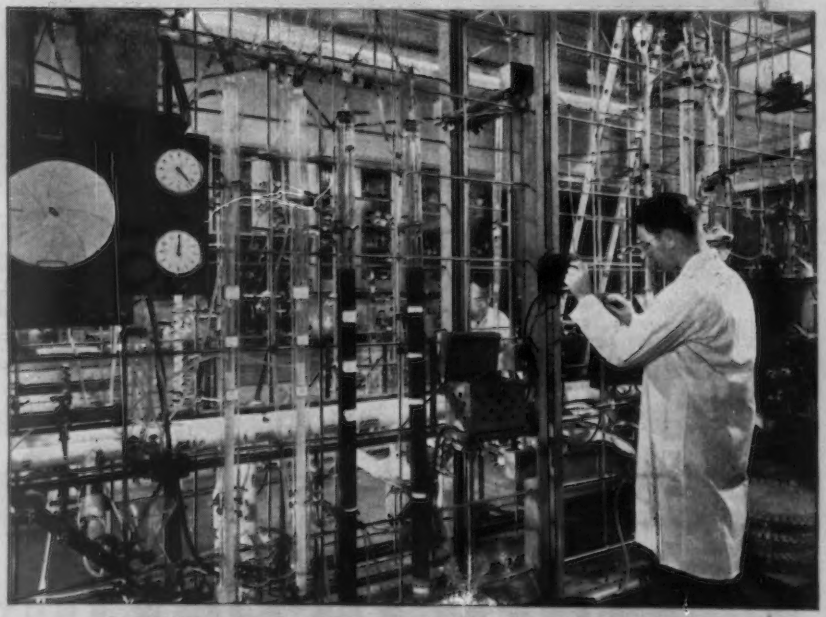
Recovering lost metal values. Generally speaking, there are three areas in which ion exchange can be profitably employed. (1) Where metal values are being recovered by less economical methods. (2) Where metal values are being lost. (In many cases, ion exchange is used in a supplementary role to obtain additional yield from solutions already processed by other methods.) (3) Where recovery of metal values is otherwise economically impractical.

Higher grade, lower cost. The use of ion exchange resins in recovering uranium has been tested and proved in the field under widely diverse operating conditions. In the U. S., Canada and South Africa, uranium processors are using these remarkable plastic "beads".

Several "standard" ion exchange resins (all trademarked Dowex®) are available to the mining industry from Dow including the well-known Dowex 1, Dowex 11 and Dowex 21K. Field tests with metallic ores are constantly in progress and developmental programs are now under way to provide specialized ion exchange resins for particular applications. Dow has issued a standing invitation to the mining industry to bring its recovery problems to the attention of Dow technical men.

Dow laboratories are equipped to aid individual processors on specific ion exchange problems. And Dow has built up a wealth of experience and know-how on the subject over the years.

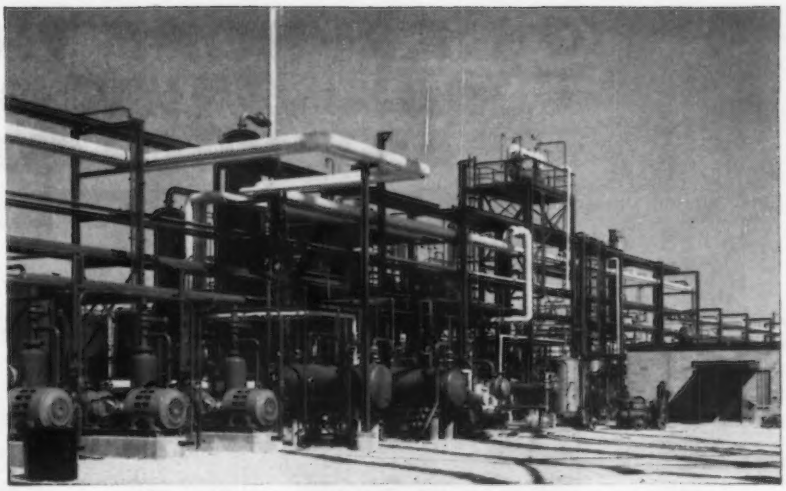
Lanthanide rare earths. One new developmental area shows excellent promise for the immediate future: separation of minor metals from pregnant



Special laboratory investigations lead to product improvement. Recent examples are the two new ion exchange resins, Dowex 21K and 21K RIP.

liquor solutions. Columbium and tantalum and the rare earths have been successfully separated in commercial quantities. The entire Lanthanide series of rare earths plus scandium and yttrium have been fractionated commercially by ion exchange. And these developments have barely scratched the surface of potential uses.

A new technical study on ion exchange is now being prepared at Dow. Soon to be published, this comprehensive work will serve as a basic text on ion exchange. You are urged to use this new book for reference. To reserve your copy, write to the address below on your company letterhead. You will receive a copy of the new book as soon as it is available.



New Texas plant offers customers better service on chelating agents.

VERSENE—

chelation value and volume

Metallurgists who use the curious chemistry of chelation in their processing are happy to note the increasing economy of Versene® 100 (trademark of Dow's most versatile chelating agent). Others may interpret the trend to mean that now is a good time to try this versatile chelating agent.

Although relatively new in the mining chemical lineup, Versene 100 has established itself as an excellent filter cloth cleaner and descaler by its ability to inactivate certain metal ions. New Dow production facilities in Texas assure abundant supply of the industry's widest range of chelating agents.

XANTHATES—*nine roads to recovery*

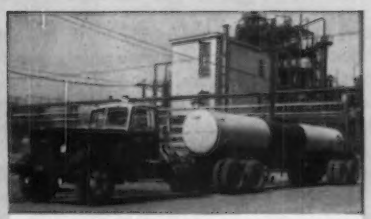
Any time you can make a metallurgist's efforts more effective, you're doing him a big favor. That's why Dow Xanthates are so popular in mineral recovery operations. These highly selective collectors—there are nine of them in all—do a topnotch job. Dow Xanthates are a favorite of the men who handle them, too. That's because they're in pellet form. No dust—and no waste, either! Makes for both handling ease and economy.

"Flotation Fundamentals" is the Dow handbook on mining chemicals. The new 108-page edition, just out, thoroughly discusses Xanthates and other Dow mining chemicals such as Dowfroth® and Separan®. Also included are sections on ore testing, milling calculations and interpretation of comparative metallurgical data. A sixteen-page table gives properties of metallic and nonmetallic minerals.

If you'd like to know more about Dow mining chemicals, contact your nearest Dow sales office or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Sales Department 765J.

ON THE MINING CHEMICAL NEWSFRONT

SEPARAN® FLOCCULANTS—Separan NP20 has joined the well established Separan NP10 in solving difficult filtration and settling problems.



CAUSTIC SODA—Note for those using caustic to precipitate uranium from pregnant solution: new Dow terminal in Grants, N. M., now serving industry.

CALCIUM CHLORIDE—Protect coal and ore from freezing with Peladow® (94-97% calcium chloride in pellets) or Dowflake® (77-80% calcium chloride in flake form).

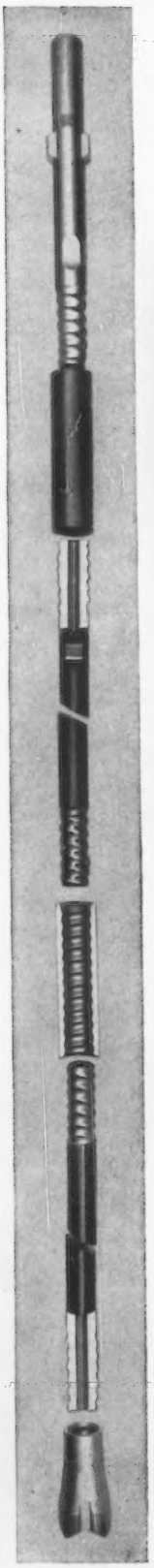
MAGNESIUM HYDROXIDE—New idea in precipitants . . . more reactive, more responsive, freer flowing, does not lump in storage. Uranium processors now using.

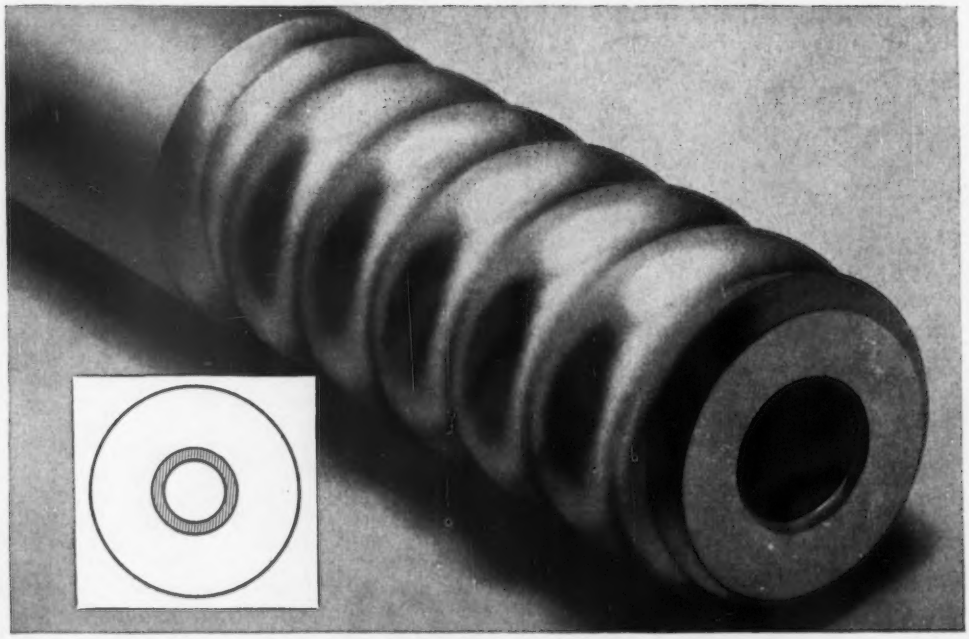
DOW CHEMICALS *basic to the mining industry*

Flocculants • Ion Exchange Resins • Preservatives • Chelating Agents
Ammonia • Solvent Extractants • Hydrochloric Acid • Frothers • Chlorine
Calcium Chloride • Alkalies • Flotation Agents

YOU CAN DEPEND ON DOW

NEW ROPE THREAD MAKES UNCOUPLING EASY WITH SANDVIK COROMANT EXTENSION STEELS





Rope-Type Threads Afford No Starting Points for Fractures

Connections used in extension drill-steel must be easy to assemble and uncouple, and connections must not become weak links during the actual drilling. Sandvik Coromant's new patented rope thread makes it easy to join and uncouple the equipment . . . yet gives a solid and positive connection. The gently rounded form of this thread means trouble-free performance—eliminates common thread and coupling failures found in "saw-tooth" threads. The complete equipment—bit, rod, coupling sleeve and shank adapter—are all dependable Sandvik Coromant parts made of world-renowned Sandvik alloy steel. A further advantage to the user is that the steel can be re-threaded. Atlas Copco has special literature on Sandvik Coromant extension steel and long-hole drilling, available to you with no obligation. We suggest you write today!

Atlas Copco

610 Industrial Ave.
Paramus, New Jersey

930 Brittan Ave.
San Carlos, Calif.

Distributors of COMPRESSORS, ROCK DRILLS, PNEUMATIC EQUIPMENT, SANDVIK COROMANT DRILL STEEL and CARBIDE BITS

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

AEROSPRAY 52 Binder reduces wind loss in mineral fines shipment . . . prevents stockpile erosion*

AEROSPRAY 52 Binder is a concentrated resin emulsion which is finding wide application in the mining industry. First used to prevent wind loss of fine coal in transit, AEROSPRAY 52 Binder is now also used to treat shipments of sulfide concentrates and coke breeze. It also is effective for preventing dusting and rain erosion of stockpiled fines and tailings.

For example, coal losses in a 400-mile haul have been reduced substantially by treatment with AEROSPRAY 52. Formerly, unsprayed cars lost as much as three to four tons in transit.

Applied as a water spray, AEROSPRAY 52 sets up to form a tough crust in the surface layer of the mineral or coal fines. As shipped, AEROSPRAY 52 Binder contains 46 to 48% solids and is diluted with water to 3 to 10% for spraying.

Write for our brochure on AEROSPRAY 52 Binder. Samples are available on request.

*Trademark

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
160 Bloor Street East,
Toronto 1, Ontario, Canada

CYANAMID DE MEXICO, S.A.
Apartado Postal 283
Mexico 1, D.F., Mexico

CYANAMID OF GREAT BRITAIN LTD.
Bush House, Aldwych, London W. C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
P. O. Box 7552,
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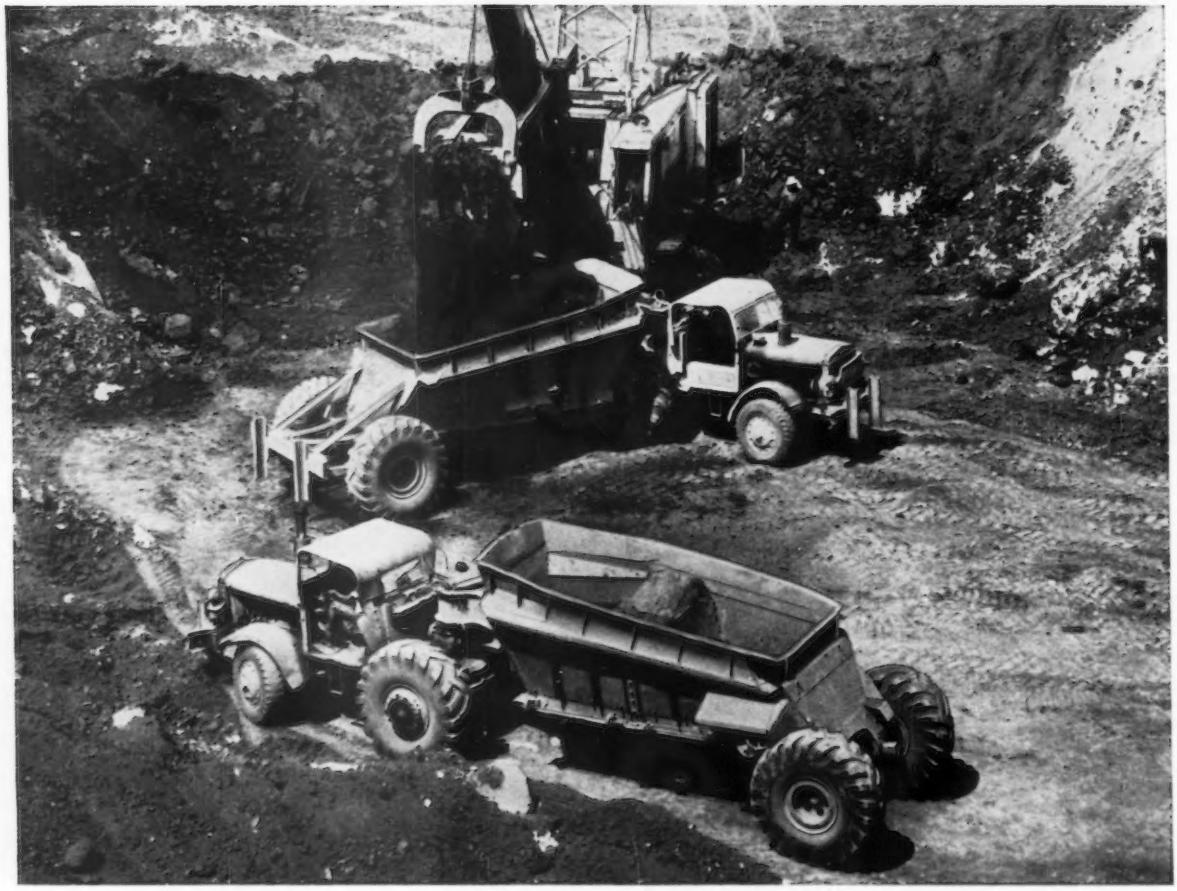


5 years of dependable performance at big bauxite mine in JAMAICA

The mining and export of bauxite ore for the production of aluminum is a major industry in Jamaica . . . one that is making an important contribution to the economic progress of this historically famous Caribbean island.

Reynolds Jamaica Mines Ltd. is one of the largest operations, shipping over a million tons of ore annually to plants of Reynolds Metals Co. in the United States. The red ore is loaded by big diesel power shovels into a fleet of 15 Euclid haulers — eight Bottom-Dumps of 15 cu. yd. capacity, and 7 Rear-Dumps that carry 22-ton payloads.

Hauls from the pits to the stockpile area are up to 7000′ in length — over marl-base roads cut through the tropical country — with adverse grades up to 6%. The "Eucs" make the one-way haul in an average of six minutes and work around the clock on a 3 shift 5 day week operation to feed the kilns and 6 mile overhead tramways to the ship docks in Ocho Rios.

The Euclid fleet has been on this continuous, rugged operation for 5 years and has maintained full production requirements. Excellent maintenance, combined with the built-in dependable performance of Euclid design, has resulted in very high machine availability for Reynolds Jamaica Mines.

For helpful facts and figures on how Euclid equipment — rear-dumps, bottom-dumps, scrapers and crawler tractors — can cut costs on your mine, quarry or construction jobs, contact the Euclid dealer in your area or write:

Engineered to fit the job . . .
Euclids are your best investment

GM GENERAL MOTORS EUCLID

EUCLID
Division of General Motors Corporation
Cleveland 17, Ohio

call KE for plant expansion or new facilities

INGENUITY

has made KE a major engineer-contractor serving Minerals

Design of a concentrating plant to process 60,000 tons of iron ore per day. Open pit bauxite facilities. Coking coal processing plants. Diatomite plants. Cement plants. These are a few of many projects and studies Kaiser Engineers undertakes for the Minerals industries in the United States and world-wide—Quebec, Jamaica, Mexico, Brazil, Australia, New Zealand, Greece, Turkey, India.

From determination of process through design and construction of complete facilities, KE can perform any or all steps. And perform them with Ingenuity—to produce a more efficient operation, in less time, at lower cost.

For your next facility—whether ferrous, non-ferrous or non-metallic—call KE.

Pendulum ore conveyor—Ingenuity produced KE innovation distributing beneficiated iron ore in 180° crescent; conserved space, cut rehandling costs.

KAISER ENGINEERS

KAISER ENGINEERS engineers-contractors
Contracting since 1914

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D. C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

4880

Dumping uranium ore at reduction mill in Moab, Utah. The bluff in the background indicates the terrain encountered by G. P. Decker's Macks, which are...

hauling today's most crucial cargo —uranium

Tortuous terrain, crisscrossed by deep canyons, arroyos and stretches of drifting sand, characterizes the "Four Corners" area of Utah, Colorado, New Mexico and Arizona, where a large amount of America's uranium is mined.

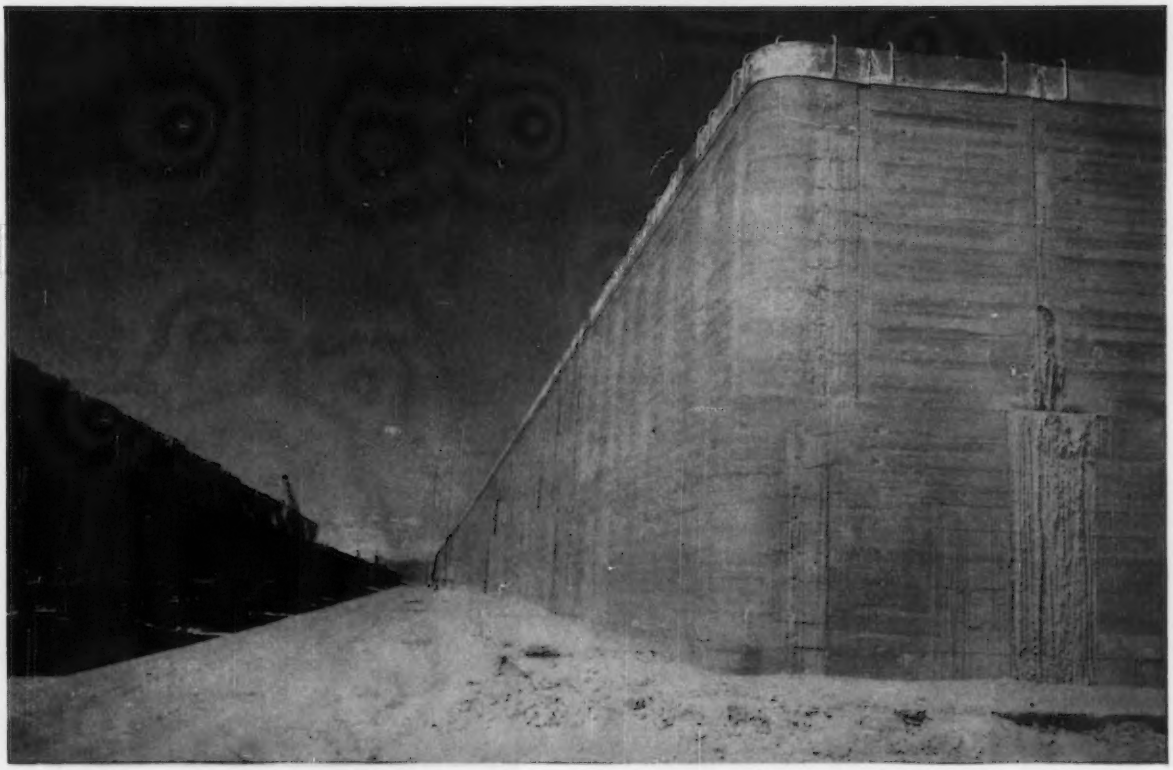
Truck operations here are hazardous and expensive. Despite these conditions, the uranium ore must be moved from the remote mines to the reduction mill in Moab, Utah. G. P. Decker is one of the more successful uranium haulage contractors in this area who depends on Macks.

Mr. Decker started out with 4 Mack diesels. He now operates 16. He has found that Mack's powerful diesel engine, coupled with the Mack 20-speed Quadruplex transmission, makes short work of the steep grades and winding roads encountered in this area. Mack's exclusive Balanced Bogie with Power Divider, which applies power to the wheels with the most traction, gives safe, sure pulling power, even through the windswept sand that drifts across the roads.

Mack's low-cost upkeep, minimum down time, and large capacity payloads mean a more profitable operation for Mr. Decker. They will for you, too. Your nearest Mack representative will be glad to give you the names of Mack users near you. You will find them as pleased with their Macks as Mr. Decker is with his. Mack Trucks, Inc., Plainfield, N. J. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

5777



Stockpiling

...a continuing company policy established years ago

Stockpiling is a measure of service.

The government is stockpiling strategic materials for its long range defense program. Thus, it serves the citizenry. The producer of a raw material who as a company policy stockpiles also serves . . . serves its customers who in turn serve others by being able to count on a supply of the raw material in quantity.

The policy of Texas Gulf Sulphur Company has always been to stockpile . . . always producing *extra* for the future. In spite of the growing demands for the important basic material it produces—Sulphur . . . the company's policy has been to keep on hand stocks equal to about a year's normal demand. With such a supply, it can make shipments, routine or emergency, of any tonnage, at any time, by any method.

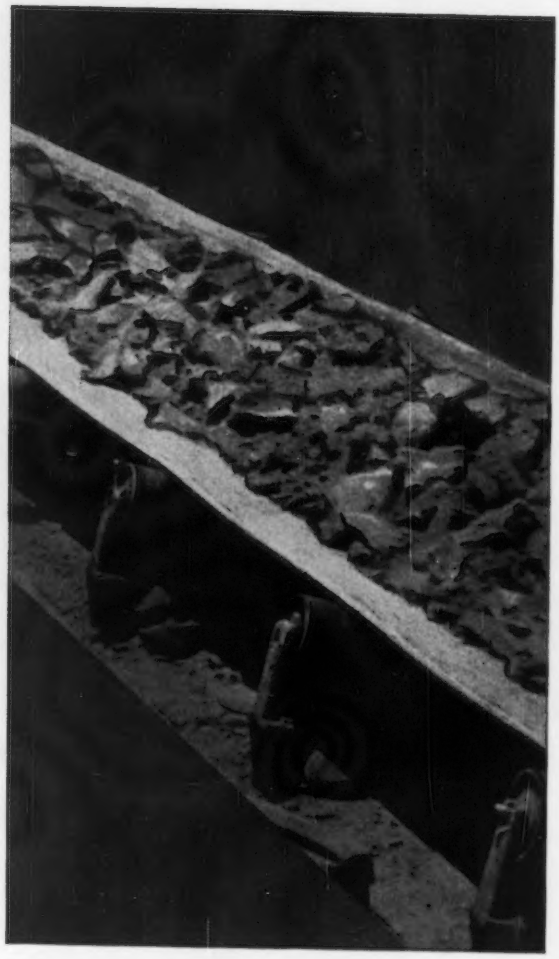
Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units

Newgulf, Texas
Moss Bluff, Texas
Spindletop, Texas
Worland, Wyoming

WHY BUY



ONLY 2/3 OF A BELT?

...it's the Last Third of an R/M Conveyor Belt that Gives

"More Use ~~per~~ *for your* Dollar"

It's the *last* one-third of conveyor belt life that determines its final cost. Real conveyor belt cost is the cost per foot of belt in terms of load carrying capacity for the *potential service life of the belt.* R/M's new conveyor belt construction now assures you ⅓ longer belt life! Here's why:

R/M engineers recognize that every belt feature—troughability, resiliency, fastener holding ability, strength member fabric, cover toughness and thickness—help determine the true cost of Ray-Man Conveyor Belt on your job. And that's why every Ray-Man component is precision proportioned to assure better belt balance where it pays off most for you—in longer belt service life!

Let an R/M representative show you how *extra* life in the last ⅓ of conveyor belt service means "More Use per Dollar" with Ray-Man Conveyor Belt and other R/M heavy duty constructions.

RAY-MAN CONVEYOR BELT

- Trains Naturally
- Resists Impact and Ripping
- Double Compensation Relieves Outer-Ply Stress
- Holds Fasteners
- Requires No Breaker Ply
- Exclusive "XDC" Long-Wear Cover
- Moisture Resistant, Mildew-Proof

RM812

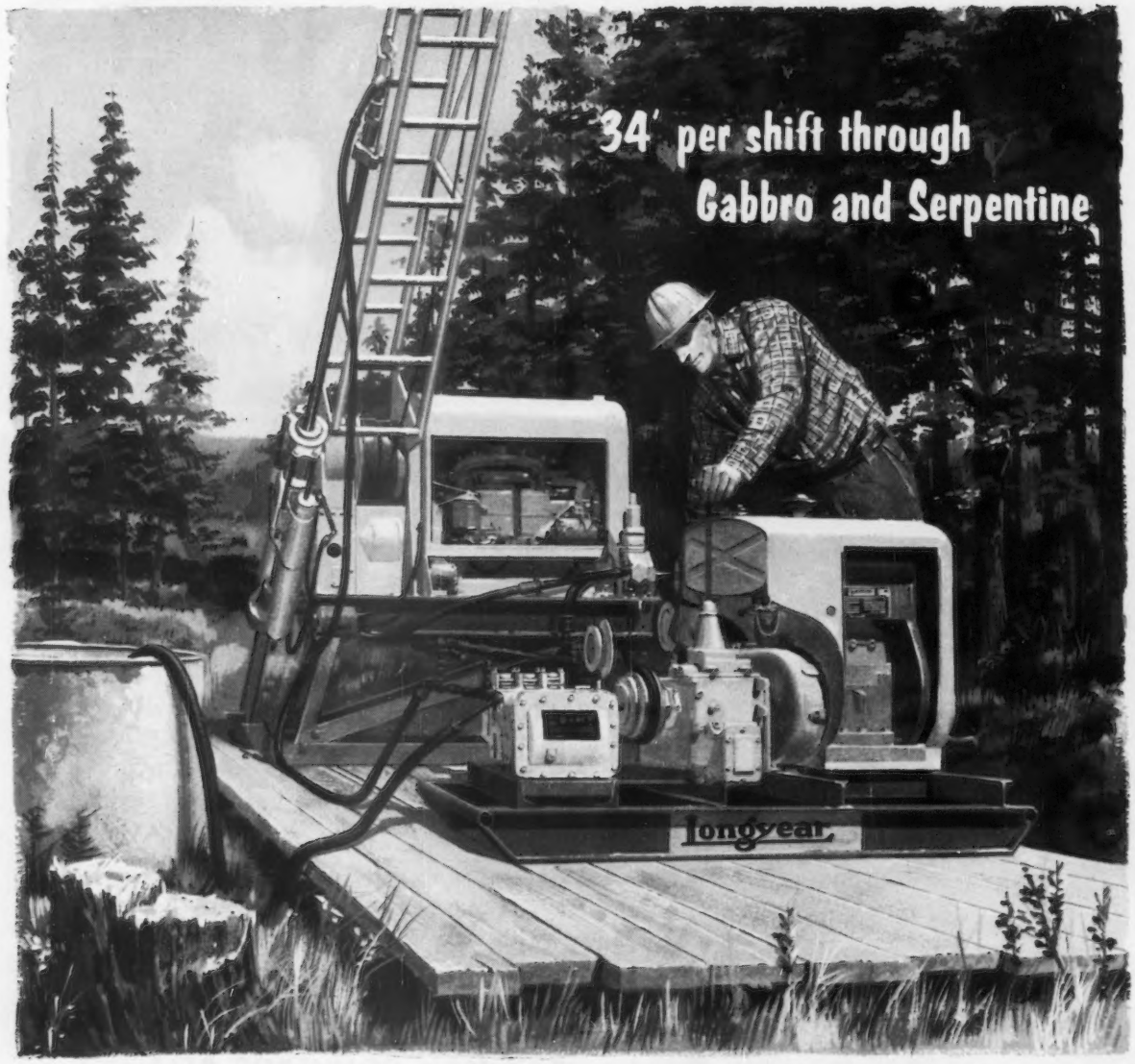
BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Report from the field...



Longyear Transmission Pumps put right volume of water into hole without bypassing

Longyear Transmission Pumps help hold the line against the continually rising cost of drilling. Here are 4 reasons why these 5 speed pumps help cut drilling costs:

1 The volume of water pumped into the hole can be controlled over a wide range of various depths.

2 Bypassing is eliminated. Thus burning and mudding of bits without the drillers knowledge is unlikely.

3 Closed current pumping is possible at every stage of the hole without changing pump liners and sheave ratios.

4 Engine runs near recommended operating speeds at all times thus minimizing carbon and sludge deposits, reducing wear on working parts, increasing engine life.

Longyear Transmission Pumps are matched in advantages and performance by other components of Longyear. *Coordinated Systems* for diamond drilling, including finest drills, drill rods, diamond bits, core barrels, and other supplies.

For complete information on Longyear Transmission Pumps, write for Longyear World No. 1, E. J. Longyear Company, Minneapolis 2, Minnesota.

E. J. LONGYEAR COMPANY
76 South 8th Street • Minneapolis 2, Minnesota
CANADIAN LONGYEAR, LTD., NORTH BAY, ONT.
LONGYEAR, N.V., THE HAGUE, HOLLAND
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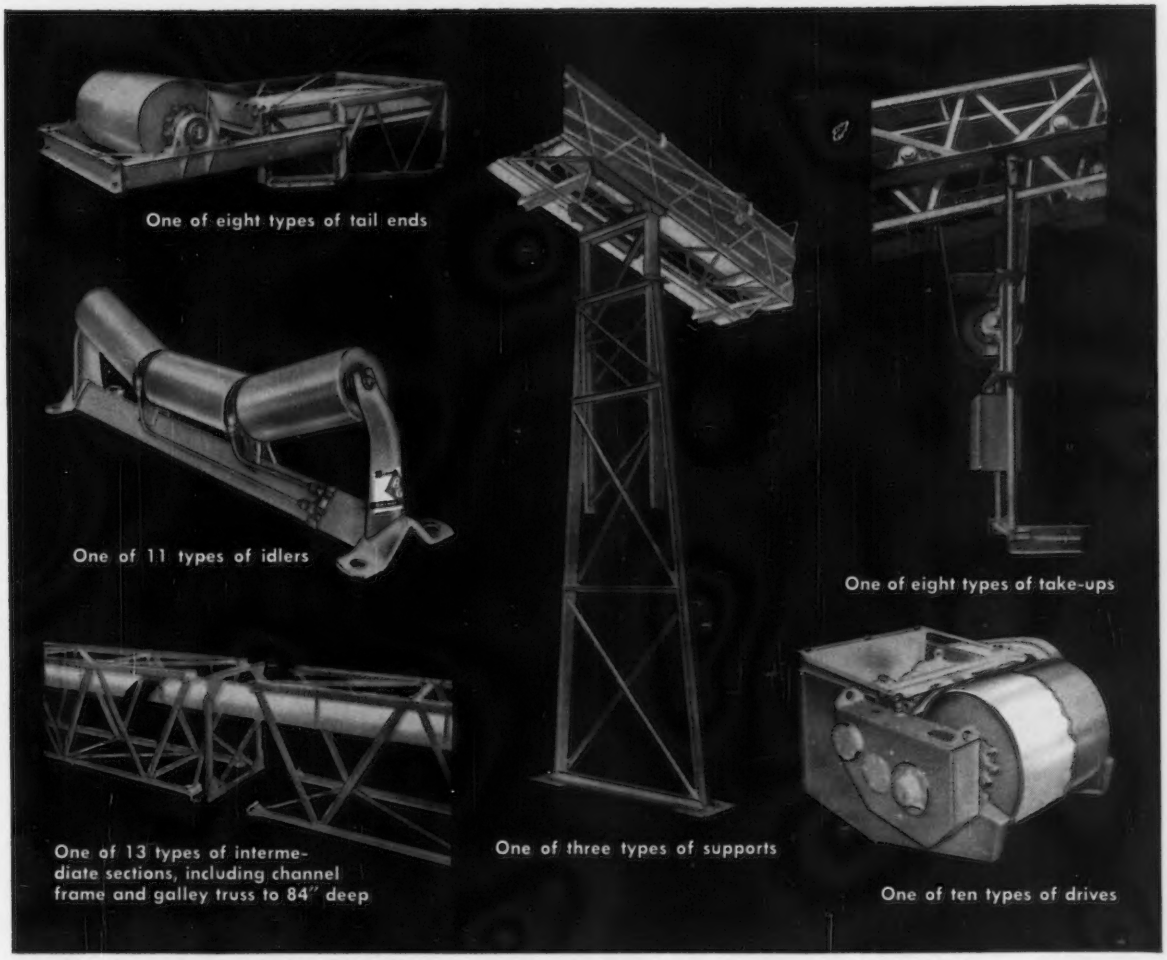
Diamond Core Drill Manufacturers • Core Drilling Contractors
Mining Engineering and Geological Consultants

VISIT OUR BOOTH #920. A.M.C. 1958 Mining Show, San Francisco, September 21-25.

Longyear

THE WORLD IS OUR WORKSHOP


One of eight types of tail ends
One of 11 types of idlers
One of 13 types of intermediate sections, including channel frame and galley truss to 84" deep
One of three types of supports
One of eight types of take-ups
One of ten types of drives

Pictured here are just a few of the many Barber-Greene standardized conveyor components. Each is available in a wide variety of types and sizes, with unmatched flexibility for countless ways of assembly. Write for new bulletin.

Boost conveyor efficiency and cut costs with Barber-Greene standardized components

Every year, more and more belt conveyor installations — long and short, simple and complex — are made up of Barber-Greene standardized, "packaged" components. This standardization means fast, off-the-shelf delivery . . . almost limitless combinations of assembly that cut time and costs on any bulk material handling job . . . components completely interchangeable . . . spare parts readily available . . . simple selection and pricing right from the catalog. Light or heavy, Barber-Greene has the complete conveyor installation you need.

You save these six ways:

- **You save special engineering time and expense.**
- **You save delivery time.**
- **You save erection time and expense.**
- **You save on alignment.**
- **You save on replacement costs.**
- **You save down time.**

58-34-PE

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

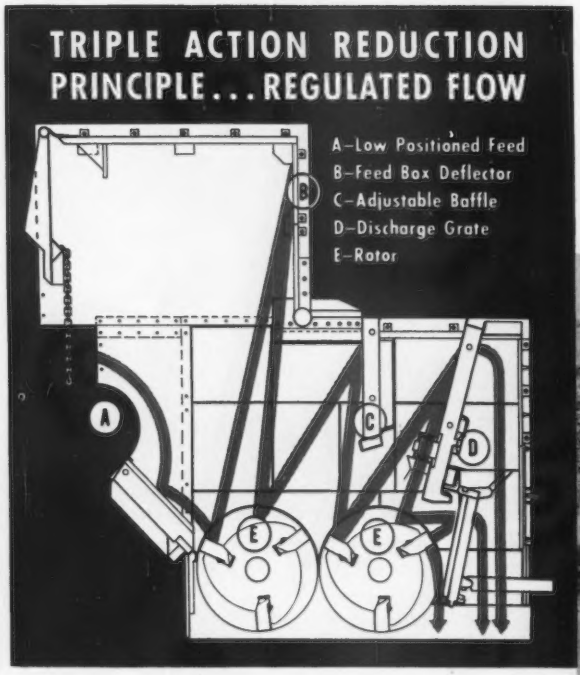
CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

HIGHER reduction ratios

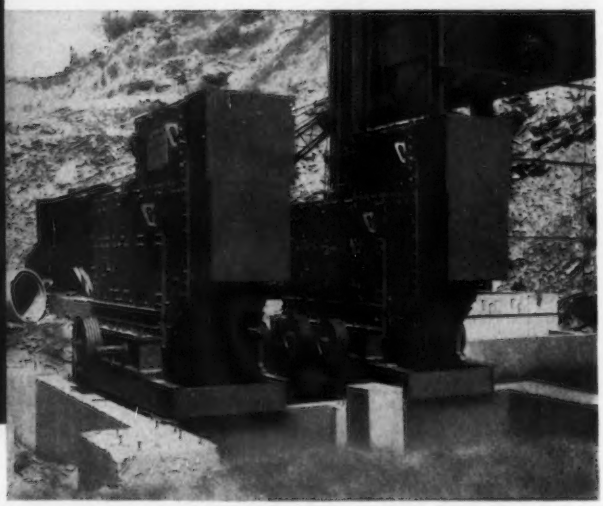
THE KENNEDY CUBER SENIOR

uses a new, proven concept in impact breaking

...for stationary or portable use



This heavy duty impact breaker is designed for primary and secondary breaking of non-abrasive stone and similar materials in a single unit. It is a dual rotor, up-running breaker featuring a multi-stage, triple action reduction principle and regulated flow.



Two Cuber Seniors in service at a Pennsylvania cement plant, operating as secondaries in a closed circuit, producing raw mill feed. The Cuber Senior can also be used as a portable unit.

THE KENNEDY CUBER SENIOR

- delivers high capacities of cubical material at lower cost —with lower horsepower per ton
- handles quarry rock that will pass its feed opening
- can be operated in a closed circuit to produce 100% passing 1" with many types of rock
- has a low positioned feed device that lowers feed height for maximum rock penetration into impact zone
- can be used as a stationary or a portable unit
- can accommodate differing characteristics of various rock types with its adjustable baffle and variable speed

We invite you to send for Bulletin D-1003 describing the Cuber Senior, and to have your material tested by KVS with no obligation to you.

KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

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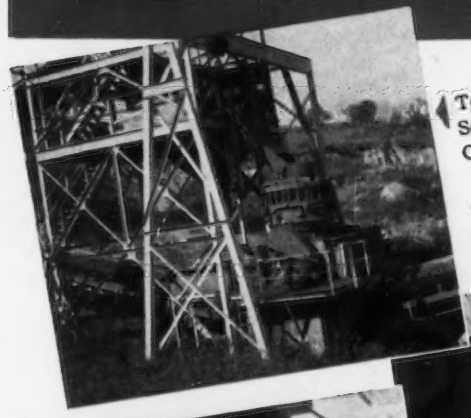
Crushing Iron Ore in South America with TELSMITH® Equipment



Telsmith 5′ x 12′ Heavy-Duty Scalper and 489S Gyrasphere Crusher.

Telsmith 25″ x 36″ Jaw Crusher and 36″x10′ Heavy-Duty Apron Feeder.

Telsmith 5′ x 12′ Heavy-Duty Finishing Screen.

• Acerias Paz de Rio, S. A.—the only steel mill in Columbia—owns this Telsmith iron ore crushing-screening plant. From the mines at Paz de Rio, the crushed ore is transported 30 miles to the steel mill at Belencito, 180 miles from Bogata. This Telsmith designed and completely Telsmith equipped plant crushes and screens 2500 tons per 8-hour day, of colitic limestone containing 48% iron. Get descriptive Bulletin 266.

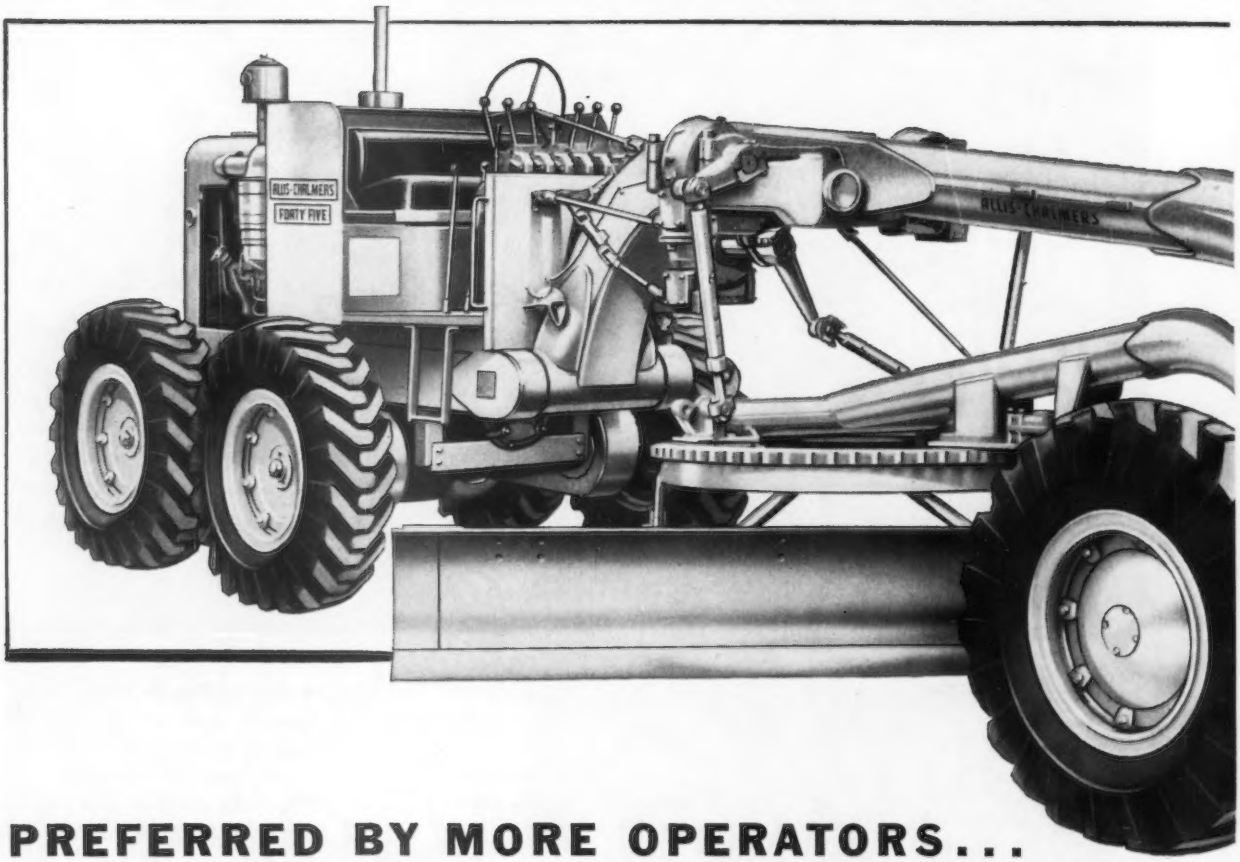
Min. 40

SMITH ENGINEERING WORKS

502 E. CAPITOL DRIVE — **MILWAUKEE 1, WISCONSIN**

Representatives in Principal Cities in All Parts of the World • **Cable Address: Sengworks, Milwaukee**

For consistently tough jobs, compare with any other heavy-duty motor grader



PREFERRED BY MORE OPERATORS... BOUGHT BY MORE USERS EVERY DAY

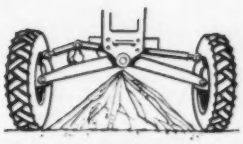
The FORTY FIVE has the power, weight, traction and speeds you need for high-production grading. Superior stability and precision control give you deep precision cuts or smooth finishes. The FORTY FIVE is built to take the shocks and strains of heavy-duty service — and to keep production steady. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Look ahead... *move ahead* ...and stay ahead with **ALLIS-CHALMERS**

Allis-Chalmers FORTY FIVE performance

- 120 brake hp
- 6 forward speeds to 20.6 mph
- 3 reverse speeds to 7.0 mph
- 23,800 lb approx.

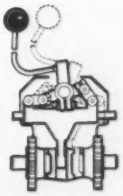
Advantages that mean more production . . . less maintenance . . . easier and better operation



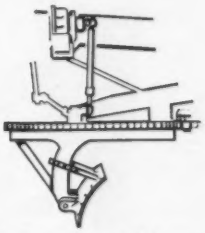
Extra high axle and throat clearance means bigger loads at the blade.

The ROLL-AWAY moldboard rolls dirt, gives more performance per horsepower, more production per gallon.

Fully enclosed power steering — easy control under all conditions.



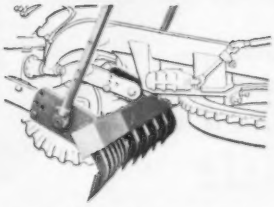
Toggle-type controls are exclusive with Allis-Chalmers.



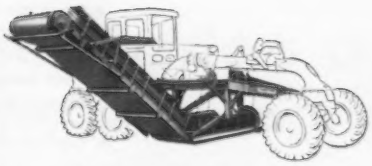
Front-mounted lift cases eliminate long shafts that twist under loads.

Matched attachments and accessories make it a year-round producer

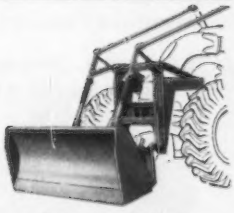
All-steel, stand-up cab



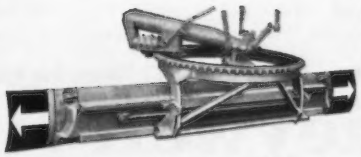
11-tooth, V-type scarifier



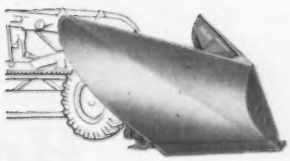
Hancock elevator



8-foot bulldozer



Hydraulic, shiftable moldboard



V-type snowplow

ROLL-AWAY is an Allis-Chalmers trademark.

No other flow meter gives you the accuracy, convenience and economy of the new Honeywell Bellows Flow Meter

- **Calibrated accuracy ± 0.5% of full scale**
- **Leakproof between liquid fill and process fluid**
- **No mercury to contaminate process fluid**
- **No zero shift between —40 and +250°F**
- **Fast range changing in field; choice of fifteen ranges**
- **High corrosion resistance**
- **Fast, accurate damping adjustment**
- **Meter body is self-venting, draining or purging**

Here's the most advanced meter body available today for flow and liquid level metering. You can use it with virtually any process fluid, with combustible fluids, and in hazardous atmospheres. Meter body has connections for either vertical or horizontal piping. Remove it from the system for servicing without disturbing the piping.

Models available in many ranges, for both flow and liquid level measurement and control. Call your nearby Honeywell field engineer for details on the new Honeywell Bellows Meter. He's as near as your phone. Or write for Catalog C22-1.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

• **Reference Data:** **Write for Catalog C22-1 "Bellows Flow Meter".**

Honeywell

First in Control

This 240,000-pound steam drum, built by Combustion Engineering for a large generating plant, is here being hoisted 120 feet into position by strong wire rope. It's a striking example of how . . .

safety rides on quality wire rope

You may never hoist loads as large as this 120-ton drum. But *safe, top quality wire rope is just as important to your own operations.* For, although the price of a "bargain" rope would be less, failure of such a rope could cost you thousands of dollars in wrecked equipment. Don't be a victim of false economy. Buy a wire rope that's a quality rope—buy Wickwire Rope.

5339

WICKWIRE ROPE — A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

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TANTALITE
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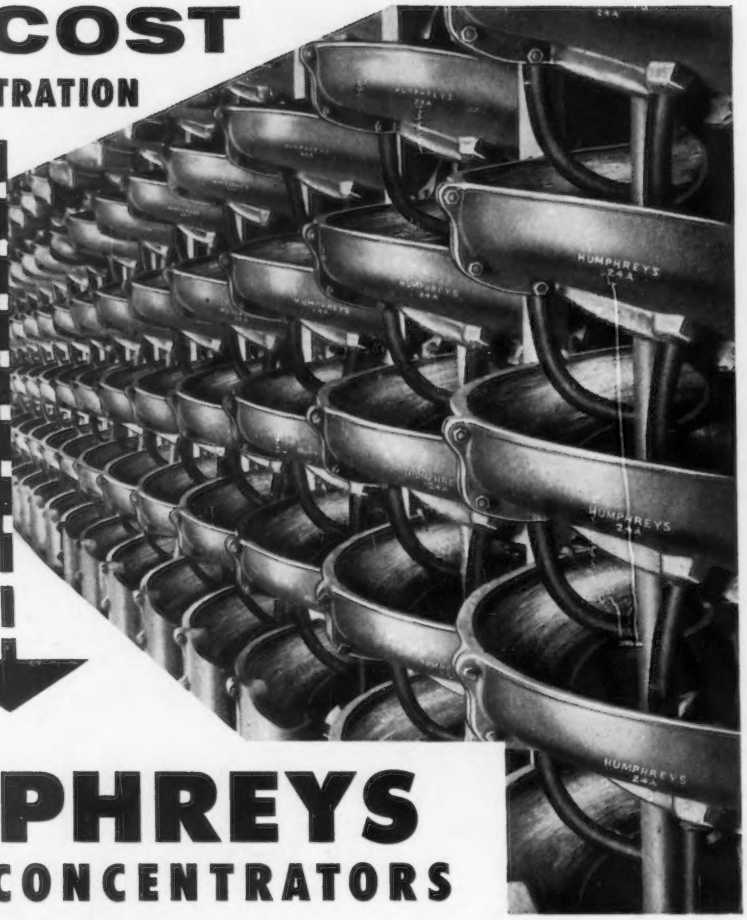
ZIRCON



HUMPHREYS
SPIRAL CONCENTRATORS

HAVE ECONOMICALLY RECOVERED THE MINERALS LISTED ABOVE

Low cost concentration becomes a reality when you install Humphreys Spirals. Economy-minded mineral producers the world over prize these efficient concentrators, their economical installation, low maintenance costs and year-round trouble-free operation. No moving parts. Small floor space.

APPLICATIONS:

Production of a finished concentrate.

Production of a bulk concentrate of several minerals and a finished tailing in one or more stages.

Scavenging the tailing from another process for the recovery of heavy minerals.

Write today for information on metallurgical tests of your ore samples for spiral treatment.

HUMPHREYS ENGINEERING COMPANY

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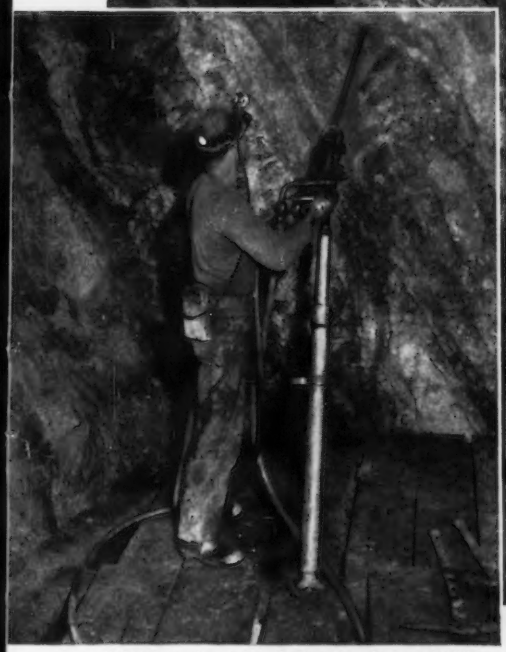
SALES AGENT—ENGLAND: THE GENERAL ELECTRIC CO., LTD. (FRASER & CHALMERS ENGINEERING WORKS) ERITH, KENT



H10AL Air Leg takes the hard work out of drilling —absorbs shock, advances the drill into the rock.

Operator can quickly and easily change position for bolting. Air Leg keeps drill in line with hole — reduces drill wear.

One Tool Handles Both Production and Rock Bolting

Le Roi H10AL Air Leg does double duty in typical stoping operation.

Recent design changes reduce wear, ease dismantling

Le Roi's H10AL Air Leg is shown here doing two jobs in a sphalerite stoping operation. Down at the 1900-foot level in a Montana mine, the operator uses both 6- and 11-foot steels while stoping. He makes an 11-foot advance per round in this horizontal breast cut and hydraulic fill stope.

After each blast, he scrapes and bolts the rock walls before drilling the next round. He doesn't need an extra tool. He merely changes the direction of his H10AL Air Leg to quickly and easily handle the rock bolting operation, too.

You can use Le Roi Air Legs as stopers, drifters, or sinkers. They have a full range of drill rotations. An exclusive 11-position feed control allows you to set and maintain any desired feed pressure from 9 psi to full line pressure. That makes it easy to keep lined-up with the hole — reduces front-end wear, eliminates rotation strain — keeps your drill-repair costs down.

There's no third hose or clumsy "Y" connection. And the Air Leg absorbs the drill recoil. That means an easily handled rig — one that won't tire out the operator, lets him get in plenty of footage with less fatigue.

New Improvements

A sturdy ball-lock connection between drill and Air Leg on recent models permits quick dismantling for easy transportation. This unit is sealed against dirt, and is far stronger than the old bayonet-style construction.

Umbrella drip shields over both pistons keep out unwanted dirt and sludge. Bleed air at both pistons will carry oil to the cup leathers and also prevent dirt from entering the working parts at bushing and piston points. Other mechanical changes and improved metallurgy reduce wear from vibration throughout the entire feeding cycle.

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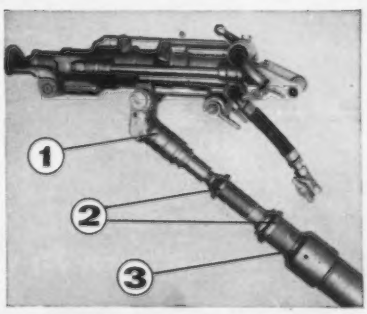

(1) Ball lock connection, (2) umbrella drip-shields, (3) sealed dirt-free construction.

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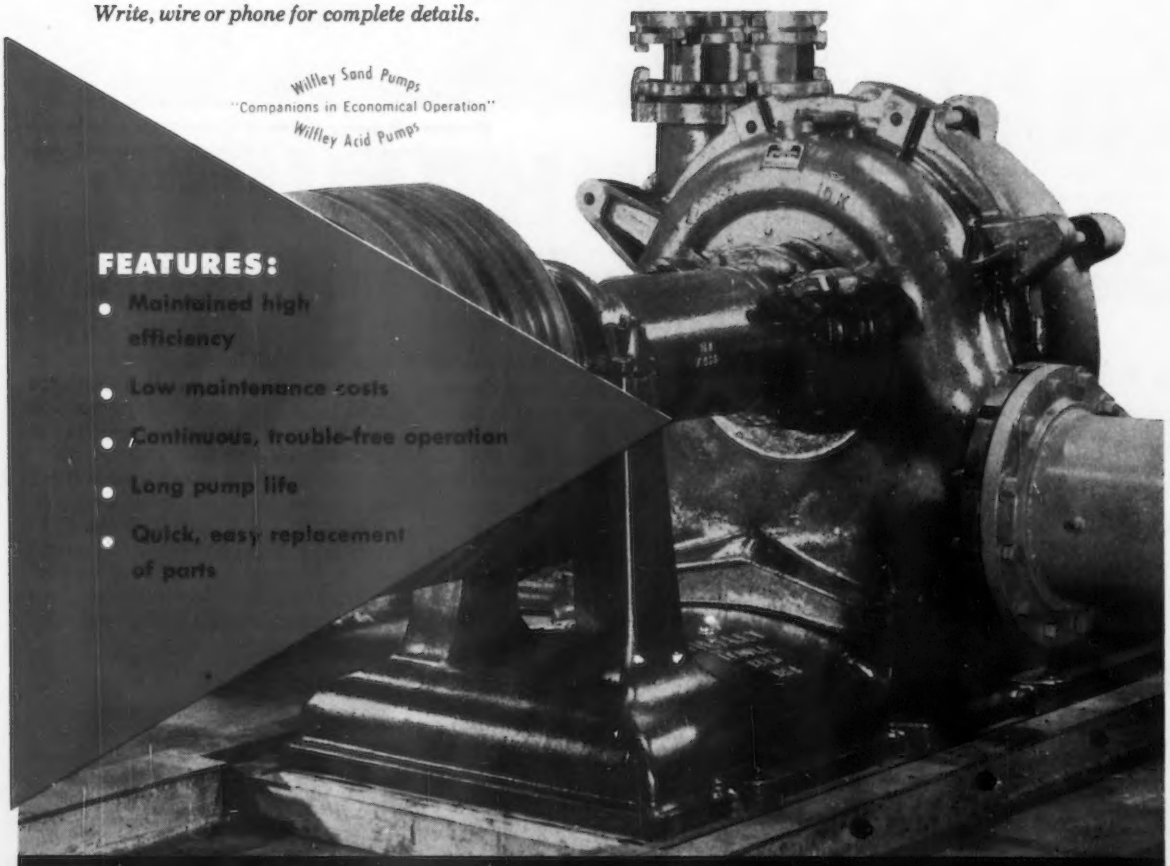

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ENGINEERING AND MINING JOURNAL

SEPTEMBER, 1958

How Is Your IE Rating?

The criticism has been made that the mining industry lags behind others in the adoption of industrial engineering (IE) principles. One mining administrator has even gone so far as to comment that unless mining engineers became more familiar with industrial engineering techniques, his company might have to look to other industries for management candidates.

Now since industrial engineering is defined as "modern scientific management," these criticisms should not be dismissed lightly by either mining companies or mining engineers. If you wish to check your company's, or your personal IE rating, run down the list of functions listed below and see how many of these techniques your company employs regularly, or how many of these functions you could direct intelligently. This list was taken from a survey made to determine the IE rating of corporations in many industries, and edited by a professional industrial engineer so that it will apply to mining's special problems.

The blanket charge that mining is dragging its feet in the employment of scientific management principles is, of course, unfair. We cite for instance the article "Guesswork Will Be Eliminated [Through] Quality Control," in *Chinorama,* published by Kennecott's Chino Division; and references to "work simplification," "suggestion systems," "inventory control," and other IE functions in the *Kennescope,* published by Kennecott's Utah Copper Division. Add to that the article by Tom Ware, president of International Minerals and Chemical Corp., "Operations Research, and the Mine of Tomorrow," *E&MJ,* August 1955, and the impressive Hollinger article, "Better Mining Through Better Management," *E&MJ,* April 1951, and you will agree that IE has arrived in the mining industry. But it certainly has not been embraced to any great extent by mining companies.

If you are in doubt about the IE rating of your company, we suggest getting a good industrial engineering handbook for your mine library. Such a handbook offers a wealth of new management concepts, devised by other industries, but applicable to mining as well. It will give you formulas, for instance, that tell you when to junk your mine machinery.—And there is a logical point at which all machinery should be junked.

IE functions can easily fit into the work of the engineering department of a mine. This branch of engineering is no more difficult than the fundamentals of civil, mechanical, metallurgical, chemical, geological and mining engineering which the versatile mining engineer has to understand to carry out his job. Engineers experienced in IE automatically become aware of management problems, and in that respect become good "management timber."

In conclusion then, it is clear that IE can help management round out its attempts to cut costs, modernize, increase output and make the mining industry more attractive to good engineering talent. The crux of it all, however, is that management must buy the idea!

A Check List of Industrial Engineering Functions

Methods
- Operation analysis and improvement
- Work simplification
- Materials handling
- Technological intelligence
- Production planning
- Clerical procedures
- Safety
- Communication systems
- Standardization

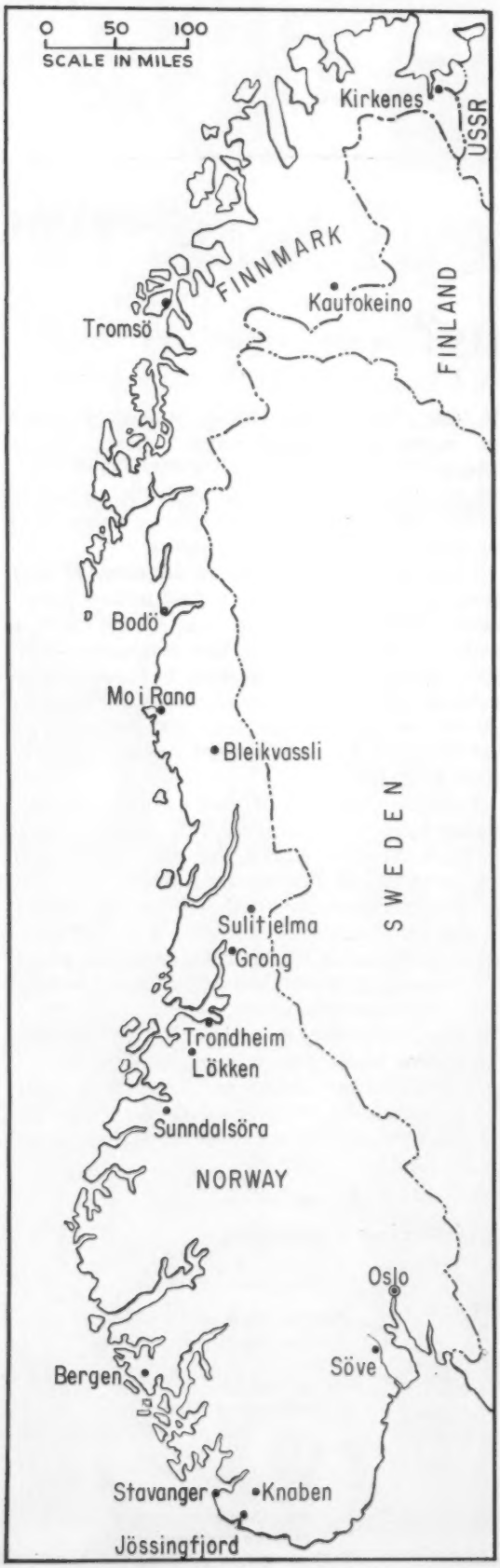
Work measurement
- Labor performance
- Cost performance
- Production performance

Wage payment
- Wage incentives
- Job evaluation
- Merit rating
- Wage and salary administration

Controls
- Production control
- Inventory control
- Quality control
- Budgetary and cost control
- Management controls

Plant facilities and design
- Plant layouts
- Equipment procurement and replacement
- Equipment and tool design

Others
- Suggestion systems
- Operations research
- Preparation of operating and maintenance manuals
- Organization planning.



Old areas are being reworked and new projects are on the way to show that . . .

Expansion Holds

NILS M. APELAND

THE NORWEGIAN MINING INDUSTRY is undergoing a period of reconstruction. A marked increase in all phases of mining activity has forced an expansion of systematic geological and geophysical mapping, and early estimates indicate that Norway's untouched ore deposits are both abundant and varied. Though the greater part of the industry's production is presently being shipped abroad in a relatively unprocessed state, there is an increasing tendency towards refining the ore at home. Refining methods are closely linked with natural facilities, either through the nature of the deposits, or through easy access to abundant supplies of cheap hydroelectric power.

Prior to WWII, Norway's central government took a passive interest in the search for, and the mining of, ores and minerals. Now, however, it sponsors most of the nation's mineral exploration projects and is by far the largest capital investor in the mining industry. After 1945, the government took over most of the foreign mining interests, so that that portion of the industry's total capital was reduced from 65% in 1939, to 25% in 1955.

In the mid-forties, the mining industry suffered from a severe lack of skilled workers. However, during the years that followed, the labor force increased tremendously. This was due in part to the housing and welfare programs introduced by the various corporations, making it possible to avoid the large turnover that plagued the industry for years. Unfortunately, there is still a shortage of geologists and mining engineers. Today the industry employs approximately 6,000 people. Production values amount to nearly $50-million a year, 75% from exports.

In trying to increase ore processing, the Norwegian government is presently considering plans to mine cupriferous pyrites in the Grong area of Nord-Trondelag. If these plans materialize, Norway will be able to export pure copper—most of the country's present production

Mr. Apeland is the former economics editor of the Oslo daily newspaper, Aftenposten.

NORWEGIAN IRON WORKS INC.'S center at Mo i Rana totals 170,000 tons of rolled products per year. Their goal is 1-million tons per year.

SUNNDALSORA and other aluminum plants have enabled Norway to boost output from 5,000 tons in 1945, to 93,000 tons last year.

The Key to Norway's Mining Future

of copper ore, coarse metal, blister copper, concentrates, etc., is shipped abroad.

At Gjersvik, in Grong, mining preparations have already begun. Several processing plans have been considered for this ore. One calls for it to be shipped to a refining plant for conversion into pure sulphur, copper, zinc and iron ore. If this scheme is adopted, a certain amount of the iron pyrites will first be sent to a small ore dressing plant. After being dried, the concentrate will be combined with the bulk pyrites, all of which is then put into a reactor, where some of the pyrites disintegrate under heating. Further along in the reaction, the iron sulphide will calcinate to iron oxide, and sulphur dioxide gas which will then be reduced to pure sulphur. Norway hopes this plan will increase the sulphur yield by applying gas from coke works or pig iron ovens and, at the same time, make the remaining iron available for the manufacture of electro-pig.

Norsk Jernverk's $75-million integrated iron and steel unit at Mo i Rana (30 miles south of the Arctic Circle) began production a couple of years ago. This government-owned center is the largest in post-war Norway, is fully electrified and is capable of producing about 170,000 tons of rolled products per year, utilizing three pig iron furnaces. An expansion project will add three more furnaces, bringing the annual output to 340,000 tons. Another proposed addition would bring the total to eight furnaces, giving a yearly output of about 1-million tons.

The work's present electrical demand is between 90 and 100 megawatts. To supply this, the new underground hydroelectric station at Rossaga, 25 miles away, is being expanded.

Field Units Hunt Arctic Copper

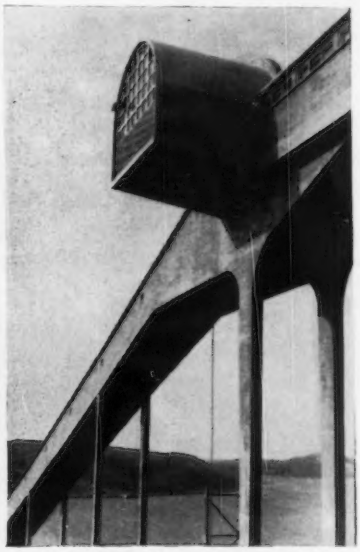
In terms of geology, northern Norway's Finnmark County is practically a *terra incognita*. For the past three summers, about 50 men from several countries have been carrying out an extensive program of copper exploration. During the winter, the copper survey operates from a camp which lies 50 kilometers from Kautokeino, at the base of a crag called Biddjovagge. The building of this camp represents an interesting chapter in the history of Norwegian mining. It consists of only 10 trailers, a mess building, a small laboratory, workshop and laundry. However, all this had to be transported across long roadless distances—Bidjovagge lies in an area where there's hardly even a tree.

The Bidjovagge deposits hold copper sulphides, pyrites, iron ore and some gold. Approximately 2- to 3-million tons of copper pyrites have been found—at least 6-million tons are needed before operations can be considered. These deposits are in an area that would call for nothing but the most expensive type mining operation. Therefore, enough ore must be found to support a pyrite yield of from 200,000 to 250,000 tons per year over a 25-year period. If this project were begun, it would support a permanent work force of 150 men.

To the North for Uranium

Norwegian gold has lost some of its glitter. Nowadays, it is uranium that holds the attention of most of the independent prospectors. During the spring and summer, reports of uranium strikes pour in from all parts of the country. Many of these have come from Finnmark, far north of the Arctic Circle and, once again, many miles from civilization. Last summer this area was explored by field units from Norges Geologiske Undersokelse (Norwegian Geological Survey). After a couple of months' hectic activity, they reported that the district contained large fields of radioactive ore. Deposits in Njallaacce, at Reisadalen in the Nordreisa area, were said to have extended for several miles.

Samples were taken from a 2,000x50-meter area. These when fully analyzed, will give the region's average uranium content. The deposits are in the northern wastelands where the winter temperature may fall as low as



SYDVARANGER INC., at Kirkenes, in northern Norway, is the principal iron ore producer. This year it plans to mine well over 1-million tons of concentrates containing 66% iron and 0.01% each of phosphorus and sulphur.

—40 deg C, and the ore will once again have to be very high grade before it can be mined at a profit.

Survey geologists equipped with only portable diamond drilling equipment managed to reach depths of 20 to 30 meters. Certain potentially high grade uranium areas had to be overlooked—the valley's ore is located in dangerous landslide terrain, and the crew had to drill only where it felt safe and not necessarily where it received strong geiger readings.

Ferro-Columbium Becomes an Export

Last year, ferro-columbium was added to the list of Norwegian mining exports. The metal is produced by A/S Norsk Bergverk, whose mine at Sove in Telemark is the only one in Europe. Most of Sove's production is exported as columbite concentrates. The ore is initially processed to form a preliminary concentrate containing about 8% columbite oxide. This is then sent to Norsk Hydro's plant at Porsgrunn, where it is treated with nitric acid to remove the apatite and the remaining lime, which Norsk Hydro uses to make fertilizers. The finished concentrate, now containing about 40 to 50% columbite oxide, is returned to Sove where it is packed for export.

In 1956, Norsk Bergverk decided to go a step further in their refining process, and built facilities for smelting the columbite oxide to form ferro-columbum. A great deal had to be done before reaching the ferro-columbium stage. For instance, last year the company blasted as much as 100,000 tons of ore to get about 400 tons of concentrates. From this amount, not more than 200 tons of ferro-columbium could be made.

Sove district deposits are among the rarest in the world. There are similar orebodies in Bavaria, and a number of deposits in Nigeria, Malaya and Russia. However, Sove ores are the only ones actually mined in Europe.

Aluminum Output Increases

The rising curve of aluminum production is one of the features of Norway's industrial picture. From 31,000 tons in 1939, production dipped as a result of the war to under 5,000 tons in 1945. Since then, output has steadily increased and last year reached a level of 93,000 tons. A new plant started production this year and existing plants are being expanded. Within a few years, Norway's total aluminum production will be 200,000 tons per year—double the present level.

The reason for Norway's leading role in aluminum is the possession of large quantities of cheap hydro electric power. The country's generating capacity is now approaching 5-million kilowatts. This is the highest development per capita in the world, and experts predict that this can be trebled, perhaps quadrupled.

The most recent adventure in Norwegian mining is that of Titania A/S, affiliated with the National Lead Co. (U.S.). A couple of years ago, Titania hired an English firm to survey the district around Hauge i Dalana, where Titania's present plants are located. The aerial survey plus follow-up investigations showed that a 350-million-ton body of ilmenite was barely 8 kilometers from the company's operations.

Titania announced that it would build a new plant, (scheduled for completion in 1960) to mine these newly discovered reserves. This plant will produce ilmenite concentrates at the rate of 300,000 tons per year, giving a yearly income of about $5-million. The plant itself will cost an estimated $10-million.

The 200,000 tons of ilmenite concentrates that Titania is currently producing per year (containing 44% titanium oxide and 35% iron) is from 12 to 14% of the world's yearly output.

For several years Titania has been trying to find economically feasible methods for refining the ilmenite ore into titanium metal. At the company's research laboratories in Jossingfjord, a method has been developed which makes it possible to remove iron from the ilmenite, resulting in a raw material containing 45 to 50% titanium oxide, which may then be transformed into sponge titanium and finally to titanium metal.

The question of whether or not the company will adopt this method is one which rests on the involved costs. The company also has to take the Free Trade Area project into consideration. If European custom barriers are removed, it may be profitable for the company to produce titanium pigments that the present buyers are now extracting from the ilmenite concentrates they import from Norway.

AT WAR-FAMED JOSSINGFJORD, in the extreme southern portion of the country, Titania Inc.'s research technicians have found a method which draws iron from ilmenite to get titanium oxide; then sponge titanium; and, finally, titanium metal.

Over-All Production Figures

Norway, and its mining industry, have felt the effects of the world-wide recession. However, projects already under way are likely to be fulfilled and most of the mines feel that they might be able to keep this year's production at the 1957 level.

Here are some of the major operations:

The principal iron ore producer, A/S Sydvaranger at Kirkenes in northern Norway, has even been able to step up production from last year's level and intends to mine well over 1-million tons of concentrate containing 66% iron and 0.01% each of phosphorus and sulphur. Sydvaranger's ore (32% iron and concentrated by magnetic separation) is of the same type as the magnetite-taconite ores of the Lake Superior region.

Next in size among the iron ore companies is the Fosdalen Bergverks Inc. in the Trondheim area. This company annually produces about 225,000 tons of concentrates. Other iron operations include the Christiania Spigerverk (Christiania Nail Co.) which produces concentrates containing vanadium, and the Softestad mines in Telemark, producing magnetite-hematite ore with 58% iron and 1 to 2% phosphorus.

Lokken Verk, near Trondheim, with an annual output of approximately 400,000 tons, is Norway's largest pyrite firm. Most of the output, however, is converted into sulphur and copper matte. Excluding the pyrite which undergoes mineral processing, 1957 production was close to 500,000 tons.

The other large pyrite mines are Skorovas, Bjorkasen and Sulitjelma, all in the southern part of the country. At Fosdalen and Mo i Rana, pyrite is the by-product of iron and lead-zinc mining.

Norwegian copper is almost exclusively a by-product of its pyrite mining. Total output is about 25,000 tons of concentrates from the following mines: Sulitjelma, Folldal, Killingdal, Vigsnes, Roros and Mofjellet. Most of the production is used to make blister copper at the Sulitjelma works.

Zinc output is mounting. A new mine, Bleikvassli, and Mofjellet, operated by the same company, produce zinc concentrates containing 52% copper. This company also produces lead concentrates containing 60% lead. Zinc ore is used by the electrolytic zinc works at Eitrheim, operated by A/S Det Norske Zinkkompani.

Molybdenite production is about 250 tons per year and the main producer is Knaben, near Egersund.

The following table shows major commodity production figures for the past three years.

	1955	1956	1957
Copper ore	26,672	27,829	29,953
Pyrites	843,776	852,987	831,304
Iron ore & titanium	1,413,417	1,740,454	1,697,737
Zinc & lead ores	15,071	14,548	15,929

The "Altmark Affair" — Norwegian Patriotism's By-Word

JOSSINGFJORD now plays host to A/S Titania's peaceful operations. However, during the early days of World War II, it became the scene of a major international incident.

On February 14, 1940, the German escort, *Altmark,* on its way home from operations in the North Atlantic, entered Norwegian territorial waters. Norway, at that time neutral, supplied it with an escort of one torpedo boat.

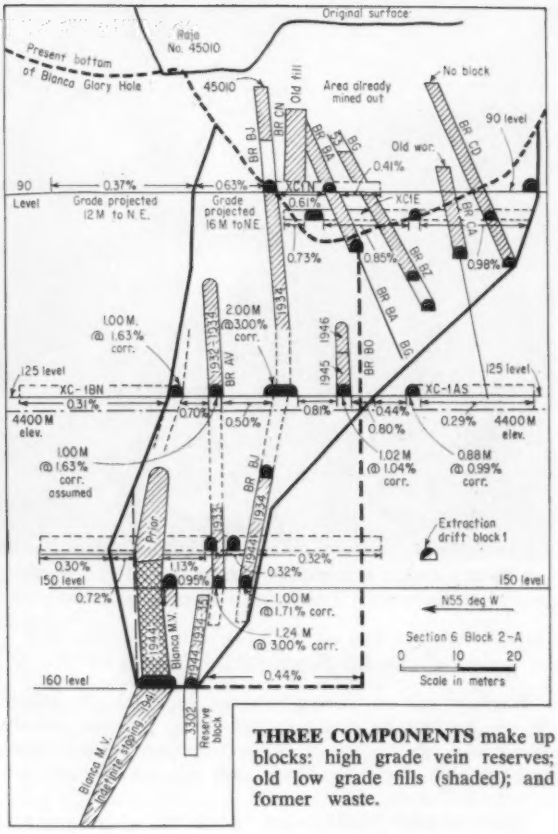
The British Admiralty, having learned that *Altmark* had been escorting the *Admiral Graf Spee* and was now transporting 300 British prisoners of war, had been given orders to rescue these men at all costs.

Cossack, a British destroyer, spotted the *Altmark* on February 16, and tried to stop it. *Altmark* entered Jossingfjord while its Norwegian escort guarded the harbor entrance. Another Norwegian ship then arrived to support the torpedo boat's position.

That same evening, despite severe Norwegian protests, *Cossack* entered the fjord. *Altmark,* while trying to dodge the English, went aground and damaged its rudder. *Cossack's* men boarded the vessel, killed six, wounded several others and made off with the 300 captives.

Shortly thereafter, Germany invaded Norway. The region that had set the stage for the "*Altmark* affair" went on to give its name to all Norwegian patriots and underground fighters—the Jossings.

BOLIVIA'S largest tin mine began caving 10 years ago. Vertical cave of Block 2 reaches surface of mountainside above Siglo XX shaft and heavy media plant and village of Llallagua. Cross section at right is just beyond (i.e., northeast of) cave.



THREE COMPONENTS make up blocks: high grade vein reserves; old low grade fills (shaded); and former waste.

Evolution of Block Caving At Catavi

HERBERT M. WEISZ

AFTER TEN YEARS OF BLOCK CAVING at the Catavi tin mine in Bolivia, it can be said that the methods adopted have proved successful. Of course, there have been changes aimed at improving working conditions and cutting costs, but the preliminary studies that prompted adoption of the method (see inset story) have been validated. Although the introduction of mass production in 1948 was necessary because of the exhaustion of vein ore, it was, nevertheless, a bold step because no uniform ore deposit was to be caved but rather old stopes and pillars of varying thickness and solidity. Experience taught us how to meet changing conditions in different rocks and mineralizations and practically every block had to be designed individually, taking advantage of experiences gained in former blocks.

Without the application of block-caving methods it would not have been possible to mine 13-million tons of pillars ("solid waste") which contain more than 91,500 tons of fine tin (see table). Block caving must also be credited with keeping up production which otherwise would have decreased to a point of preventing continuous operations. It now accounts for about 50% of the ore and 40% of the tin produced (see table) and the production program for the Llallagua mine foresees it

Mr. Weisz is general manager of Empresa Minera Catavi, Llallagua, Bolivia.

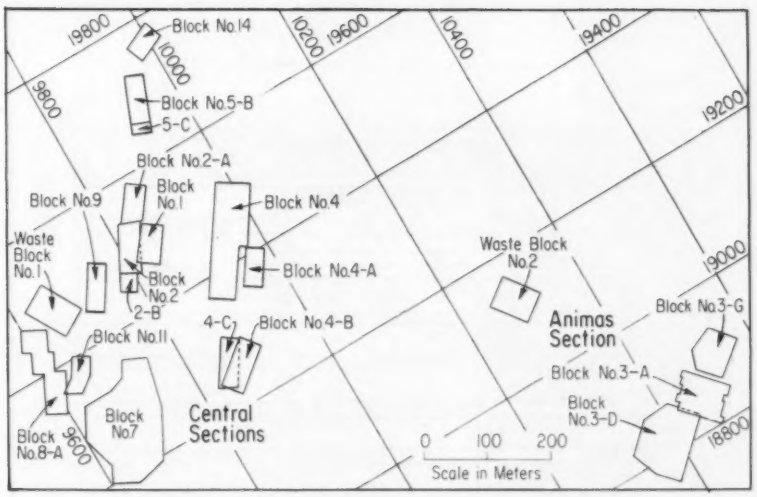
Source of Ore Caved Has Been Mostly Old Waste

	Tons ore (% of total)	% Sn	Tons Sn (% of total)
Solid waste	13,051,216 (90.54)	0.70	91,567.01 (83.40)
Old fills	1,085,215 (7.53)	0.95	10,343.33 (9.42)
Solid veins	278,997 (1.93)	2.83	7,883.52 (7.18)
Total	14,415,428 (100.00)	0.76	109,793.86 (100.00)

Mine Output Increasingly Relies on Block Caving

Year	Total mine tons ore	Block caving % Sn	Block caving Tons Sn	Block caving Tons ore (% total)	Block caving % Sn	Block caving Tons Sn (% total)
1948	1,030,067	1.61	16,627.08	3,659 (0.4)	0.92	33.62 (0.2)
1949	868,881	1.50	13,065.74	28,021 (3.2)	0.74	205 97 (1.6)
1950	1,040,113	1.29	13,429.12	239,891 (23.1)	0.61	1,452.86 (10.8)
1951	1,364,692	1.14	15,504.49	458,746 (33.6)	0.85	3,881.54 (25.0)
1952	1,318,436	1.11	14,668.67	449,806 (34.1)	0.83	3,714.03 (25.3)
1953	1,215,916	1.08	13,101.52	491,834 (40.4)	0.89	4,346.55 (33.2)
1954	1,247,402	0.94	11,732.94	533,835 (42.8)	0.66	3,528.33 (30.1)
1955	1,031,919	0.94	9,702.14	332,566 (32.2)	0.61	2,031.77 (20.9)
1956	1,312,736	0.95	12,501.63	576,845 (43.9)	0.66	3,801.87 (30.4)
1957	1,388,337	0.88	12,241.33	699,399 (50.4)	0.71	4,935.79 (40.3)

Note: Ore from dumps not included.



CAVING BLOCKS are in scattered groups and bottom at different elevations.

Several Factors Prompted Adoption

Catavi is Boliva's largest tin mine and is the only place where block caving has been introduced in the country. The "Empresa Minera Catavi," formerly operated by Patino Mines & E.C.I., is now managed by the Corporacion Minera de Bolivia, a government-owned organization which after the nationalization in 1952 administers the mines that formerly belonged to the three big companies—Patino, Hochschild and Aramayo[1].

The Catavi mine, called Siglo XX, occupies the whole Salvadora mountain, 14,900 ft high. The shaft, heavy media plant and little mining town of Llallagua are situated at the foot of the mountain. Administration center and mill are about three miles from Siglo XX at Catavi, at a 12,000-ft elevation. Catavi is about 75 miles southeast of Oruro, another famous old mining town, on the Central Railroad, 150 miles south of La Paz.

Grade Was Dropping

The tin deposits of Llallagua have been worked for more than 50 years on a regular scale and over a longer period on a smaller scale. The once rich lodes are now exhausted. From 1940 to 1950, grade of ore dropped by 50%. As the "solid" stopes became more and more exhausted, fills in old stopes were reworked as much as four times and walls were slabbed to recover rich stringers. This exploitation of the gob fills proved more expensive per ton of tin and slabbing of walls was dangerous as well as uneconomic. In addition the ore was difficult to sort and grade remained low.

In 1947 it became apparent that to permit working lower grade ore more economically, selective mining had to be replaced by bulk mining. L. D. Daume's report on operations in December of that year showed that by 1955 production would fall to approximately 500 tons of fine tin, a quantity insufficient to carry the burden of expenses. His report recommended "large scale mining of these lower grade ores by modified caving methods, and their subsequent more economical treatment."

Geology Was Favorable

Geological features to support this view were given in the report. It was stated that the mineralization of Salvadora mountain is not distributed evenly over the whole area. The ore occurs in vein systems which are sufficiently isolated to be mined as separate caving operations. (In some places veins are in groups only a few feet apart; elsewhere they are separated by 20 to 30 ft of rock. Values are in narrow veinlets or stringers in the central sections and are disseminated elsewhere as in the Animas section.) Most orebodies occur in highly altered rhyolite or quartz porphyry of volcanic origin; and although some areas are found in contact zones with sediments such as graywacke and metamorphic rocks, these are often silicified and hard and brittle which is favorable for caving. Wide veins have been worked out, mostly by shrinkage stoping or cut-and-fill methods. Block caving could take in old stopes and pilars between them which could not be worked economically by current standard methods.

Early in 1948, a study by C. M. Brinckerhoff enumerated these favorable factors for satisfactory caving methods:-

1. Relative structural weakness of the solid country rock between veins.
2. Already weakened and crushed condition of the pillars between old stopes.
3. Narrow width of the pillars.
4. Old shrinkage stopes which would serve as boundary cutoff stopes or isolation.
5. Evidence of much vertical fracturing in the mineralized zones showing the effect of weight, though there had been no visible evidence of planes of weakness.
6. Almost vertical position of the mineralized zones in the bodies to be caved.

Unfavorable factors were:

1. Crushed condition of the ground, some of which would have to contain raises, grizzly levels or workings which would require maintenance during exploitation.
2. Dampness of the ore which would cause packing.
3. Impossibility of selective mining in block areas.

The observations have been cited fully because later development of block caving methods at Llallagua has shown the correctness and importance of these observations. Other ideas and assumptions were proven wrong or mistaken as discussed below.

[1] See *E&MJ:* April 1937—Deringer, D. C., & Payne, E.I., "Patino, Leading Producer of Tin"; and November 1957—Davila-Michel, O., "How Catavi Concentrates Tin Ores."

contributing 80% of the total mine extraction. In addition, by keeping up production while sparing reserves of vein material and by adding new reserves of former sub-grade material, block caving has permitted raising reserves of mineable ore (see table below) and prolonging the life of the mine for 10 or 12 years.

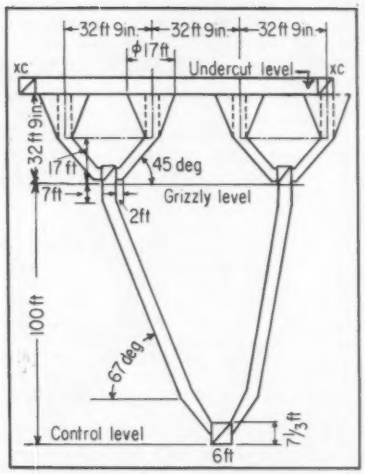
Copied Scheme Proved Faulty

To introduce block caving methods at Catavi, two engineers were sent to Potrerillos and Braden Copper in Chile, and a system copied mostly from the first of these was adopted. Two blocks were projected in waste areas, partly in the hope of gaining experience with the new mining method and partly in the hope that caving could produce cheaper waste fill.

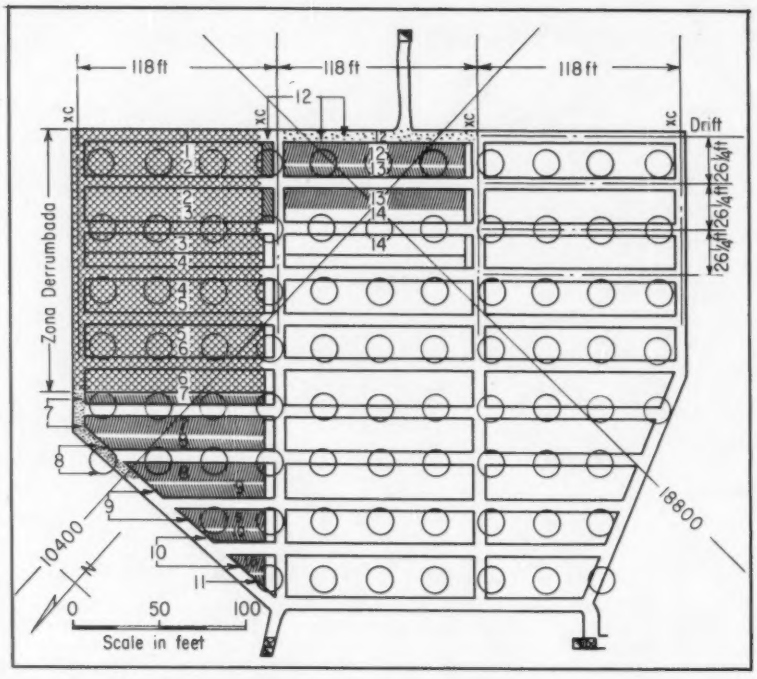
These hopes, however, were not fully realized for two reasons. The first and most important was that the geological conditions of the waste blocks were so different from those of mineralized areas that conclusions could not properly be drawn to apply on ore-blocks. The latter would be in "weak ground," i.e., areas cut by wide, old stopes and partly-mineralized, badly-crushed pillars. While the

Ore Reserves Now Count Heavily On Caving Areas

Year	Veins (% total)	Old fills (% total)	Dumps (% total)	Cavings (% total)	Total
1950	33,920 (100.00)	———	———	———	33,920
1951	27,381 (17.3)	39,953 (25.2)	19,918 (12.6)	71,264 (44.9)	158,516
1952	26,570 (16.7)	33,141 (20.8)	19,371 (12.1)	80,430 (50.4)	159,512
1953	28,659 (17.6)	27,640 (16.9)	18,589 (11.4)	88,302 (54.4)	163,190
1954	26,349 (18.8)	13,910 (9.9)	18,107 (12.9)	81,669 (58.4)	140,035
1955	24,097 (17.4)	6,127 (4.4)	11,301 (8.2)	97,103 (70.0)	138,628
1956	25,059 (18.4)	6,100 (4.5)	9,979 (7.3)	95,298 (69.8)	136,436
1957	25,333 (19.4)	5,000 (3.8)	9,383 (7.2)	90,769 (69.6)	130,683



PRESENT LAYOUT has circular cones. Dimensions are larger than first scheme.



UNDERCUTTING now follows this procedure of retreating from one corner. The numbers indicate the sequence of drilling and blasting. This is plan of Block 3D.

waste blocks were projected and prepared in solid rock areas completely devoid of veins or faults. In fact, one of these waste blocks hung up and formed a perfect arch over the caving level, from which not a single stone fell down for years after it was abandoned.

A second reason why the first trials did not meet expectations, was that the blocks caved in such big boulders that secondary blasting was very costly and exploitation cost per ton was about four times as high as securing rock fill from glory holes.

The first several ore blocks were likewise designed almost exactly after the pattern of Potrerillos. Draw cones were spaced 28x26 ft to 23x23 ft, depending on the total length of the blocks. Blocks were relatively small: 200x110 ft or 245x105 ft. Undercut level drifts and crosscuts were opened perpendicular to each other, forming a square grid and leaving the cones accessible from four sides for slabbing.

The grizzly level was generally 27 to 30 ft below the undercut level. There was one grizzly for every two cones. From the grizzly, two raises went up at 45 deg to a point 4 meters (13 ft) above the grizzly. At this point each raise split into four fingers which rose along the corners of an inverted pyramid up to the intersections of the undercut drifts and crosscuts. The inverted pyramid between the four fingers was drilled and blasted from within. The remaining pillar between the undercut drifts was drilled and blasted from the undercut level.

This system did not work well. The fingers would not always connect at the corners of the cones and the miners, instead of taking out only the pyramid, generally overdid the slabbing and produced an opening like a basket, frequently connecting with the next cone. Such excessive slabbing weakened the pillars above the grizzlies and many a grizzly had to be abandoned later because no pillar remained above it and big boulders from the undercut hung right over the grizzly.

On the other hand, much stress was laid, unnecessarily, on the proper distance between the branch raise and the corner of the main grizzly level crosscut, which should be eight feet. It was believed that this pillar would weaken. As a matter of fact, the branch raises never wore out in a horizontal direction towards the main crosscut, but rather in a vertical direction, destroying the roof pillar between grizzly and undercut. One of the most valuable lessons we learned was that a good pillar above the grizzly is of great importance.

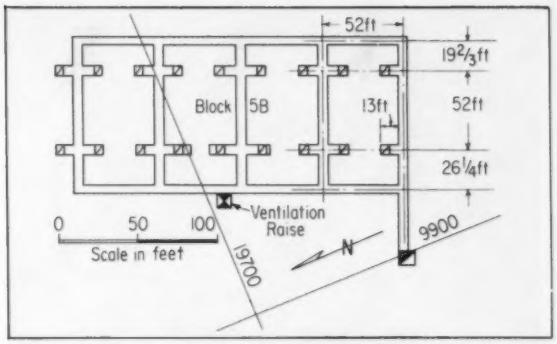
New Layout Is Perfected

In 1953 the four-finger system was replaced by a single 16-ft vertical raise which is widened to form a conical funnel 15 ft in diameter at the undercut level. Other changes included: cones on 33-ft centers, larger blocks, and an undercut level 33 ft above grizzly level (see drawing). On the undercut level the checkerboard pattern was changed to a system of parallel drifts (7 ft wide x 6 ft high) about 26 ft apart with crosscuts driven about 118 ft apart.

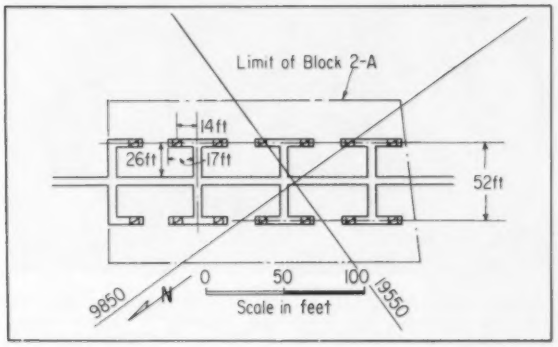
Undercutting of these 20x100-ft pillars is done by retreating from one corner of the block (see drawing). For example, in Block 3D, vertical rows of three or four 7-ft holes were drilled with Jacklegs from the boundary drift along the entire long side of the first (corner) pillar. These holes were blasted and stripped off a 6-ft slice. A small stub pillar along the interior crosscut was not blasted. Rocks from the first blast were partly drawn through the branches and partly dry-walled to protect the crew during the next drilling round. Millisecond delay blasting has given good results, reducing the size of rocks which may clog the branches.

After a second slice was drilled and blasted, operations moved into the next drift. The remaining part of the first pillar, then only about 7 ft wide, was drilled and blasted from the second drift, together with the first slice off the adjacent parallel pillar. In each case a small stub pillar was left unblasted along the interior crosscut. Undercutting proceeded down the first row of pillars and then down the second row. The stub pillars left along the first interior crosscut were removed, one at a time, with the last slice of each adjacent pillar in the second row of pillars.

For new work, it is planned to use



EARLY grizzly level lacked good ventilation at depth.



LATEST arrangement is not only better but cheaper.

OLD DRIFTS often complicate grizzly levels as in Block 7.

longer steel which will permit blasting the pillars in two rows.

The ore handling layout was another feature changed in 1953. The first blocks were provided with an "extraction" or gathering haulage level, 50 to 60 ft below the grizzly level. Transfer raises brought the ore down from the grizzly to chutes on the extraction level from which the ore was hauled by 5-ton cars and 8-ton electric locomotives to an existing or sometimes specially prepared main ore pass. There it dropped down to the 650 level, which is the main haulage level for the whole mine. Operation cost of this gathering haul was between $0.25 and $0.30 per ton of ore. Production was sometimes slowed down by traffic for various reasons.

Replacing this haulage system by an all-gravity system of branch transfer raises resulted in a saving of at least $0.20 per ton, without considering investment in new equipment. All blocks prepared after 1953 are designed with the gravity system. The biggest block prepared so far—3D, with 88,716 sq ft and 44 grizzlies—ends in two main chutes at the 650 level. In some cases there is a "control" level, similar to the old "extraction" level, general about 100 ft below the grizzly level. This is especially useful when the block contains waste inclusions (such as 3D, described later). One control chute serves each grizzly because with more than one grizzly per chute the draw becomes irregular if one cone becomes non-paying.

Ventilation Affects Layout

The first and smaller blocks had a grizzly level with boundary drifts and crosscuts forming a rectangle with a central crosscut parallel to the shorter side, something like a window frame in plan. From the crosscuts, short stub drifts gave access to each grizzly. As these blocks were close to the surface, at about 14,000 ft, natural ventilation was sufficient. But Block 5B, having three such central crosscuts with stubs and being at a lower level (more than 1,000 ft from the surface), was poorly ventilated in spite of a special ventilation raise (see drawing).

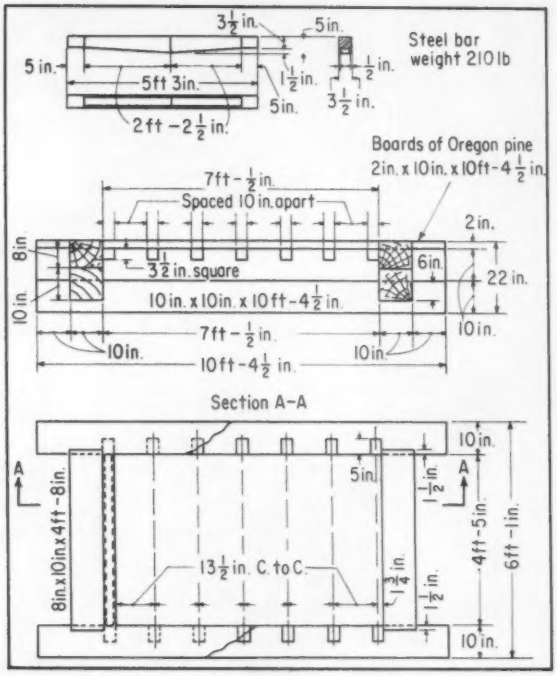
Later blocks—as 2A, 11 and 14—have had a simpler scheme with short crosscuts, T-shaped in plan, coming off one central drift running lengthwise. Grizzlies are at the ends of the cross-arm of the "T" (see drawing). This is cheaper and ventilation is better.

In some of the bigger blocks, as 3A with 45,730 sq ft of area and 34 grizzlies, a Joy Axivane mine fan for 38,200 cfm (at 14,000 ft) was installed, which discharged the air to the Animas shaft. Serious ventilation problems were encountered in Block 3D, with 44 grizzlies and up to 1.38 lb of dynamite consumption per ton (1,500 tpd). Bad ground and old stopes made necessary some relatively long grizzly crosscuts where blowers had to be installed. A 300-ft-long incline brings fresh air from the Patino tunnel and another 38,200-cfm Joy fan sucks the air out of the block and discharges the contaminated air to raises which connect to the surface.

Planning Is Critical

In the first years, lack of stope preparation induced a certain hastiness in operations, to the point that as soon as a new block was calculated and designed, all three levels (undercut, grizzly and extraction) were started together. Sometimes the undercut level was even ahead of the others, as sampling of its drifts had to be included in the block evaluation. This led to great difficulties with mucking and increased preparation costs, as all the muck from the grizzly and undercut level had to be transported by wheel barrows or cars instead of dropping it down through the raises.

It was also thought that it would save time and be economical to use


Steel bar
weight 210 lb
Boards of Oregon pine
2in. x 10in. x 10ft-4½ in.
Spaced 10 in. apart
3½ in. square
10 in. x 10in. x 10ft-4½ in.
Section A-A
13½ in. C. to C.
8in x 10in x 4ft-8in.

STANDARD GRIZZLY uses special manganese steel bars which are long lasting and maintain desired 10-in. spacing.

CONCRETE-AND-RAIL arches were designed for grizzlies and the chambers, but reinforced concrete is used in drifts.

old workings for drifts, especially on the undercut level. But it actually resulted in irregular sized cones and weakened pillars because of faulty slabbing inside the cones. Even on the extraction level of one block where an old drift was repaired and dressed up, a new drift had to be made in solid rock.

In order to procure a more or less constant blend of material from old gob fills, block caving ore and the high grade solid veins, as well as to prolong the life of the mine as much as possible, a production program has been worked out. It determines when the different blocks must start preparation, when they enter production, and how much tonnage they should yield.

For the purpose of this program, various data and experience had to be taken into account. The blocks are situated in different areas of the mine. Some are clustered in the same region but on different levels so that the higher lying blocks must be exploited first. Exploitation of some blocks, the preparation of which was started as far back as 1950, have had to be postponed as new blocks were discovered in the same area on higher levels.

The time necessary for preparation of the blocks must also be considered. Experience now shows that about one meter of lineal horizontal plus vertical preparation (i.e., development) is needed for each square meter of block area.

For instance, Block 3D, 8,245 sq meters, needed 4,493 meters of horizontal preparation and 3,675 meters for vertical preparation. In addition, for some blocks, shrinkage stopes for isolation have to be mined. This is especially so in the Animas area where the metamorphic rocks are hard and old stopes few. The capacity of this mine is limited to about 600 meters per month for block caving preparation. Thus the time necessary to prepare blocks of 16,125 sq meters (Block 7) and of 8,820 sq meters (Block 4) were important considerations in the program.

Other earlier data indicates that 10 square meters per day can be assumed as the preparation time of a new block. But in special cases, as in Block 7, the time can be shortened by concentrating more working crews and providing a special compressor in order to be able to work in two or three shifts instead of only one, as in the rest of the mine.

Unforeseen difficulties, such as concreting of drifts and transfer raises, must be taken into account, and, unfortunately, shortage of essential materials, particularly cement, are likely to upset all calculations.

Caving Needs Scheduling

Year	Vein	Dump	Other	Caving	Notes
1958	1,800	700	100	2,400	
1959	1,600	600	100	2,700	Enter 3-G
1960	1,400	400	100	3,100	Enter 4-A
1961	1,200	400	100	3,300	Enter 7
1962	1,200	400	100	3,300	Enter 4-B
1963	1,100	400	100	3,400	Enter 8-B
1964	1,000	400	100	3,500	
1965	1,000	300	100	3,600	Enter 4
1966	1,000	–	100	3,900	Enter 4-C
1967	1,000	–	100	3,900	
1968	1,000	–	100	3,900	

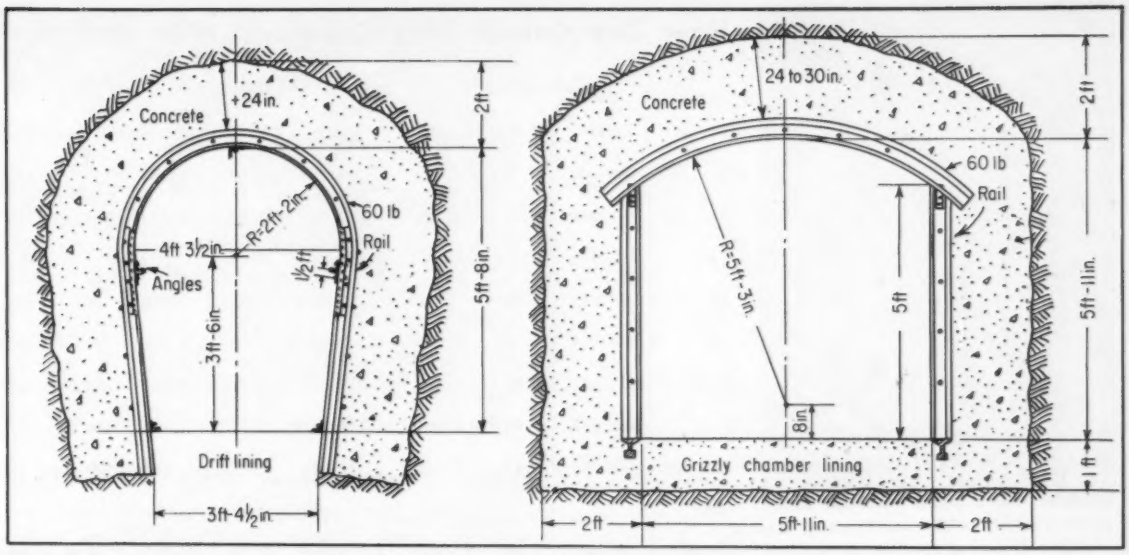
Grizzlies Are Key Spots

Secondary blasting on the grizzlies is done with Nobel Amon Gelatine

Hard Rock and Small Grizzly Equals More Dynamite

Block	1951	1952	1953	1954	1955	1956	1957
2	0.76	0.36	0.26	0.35	—	—	—
3-A	0.93	0.77	0.86	0.97	1.03	1.21	—
5-B	1.49	0.81	0.65	0.97	1.32	1.47	—
2-A	—	0.69	0.49	0.45	0.57	0.56	0.66
11	—	—	0.98	1.36	—	0.91	1.09
14	—	—	0.21	0.34	0.48	0.59	—
5-C	—	—	—	1.43	1.51	1.67	—
2-B	—	—	—	0.82	0.88	0.70	—
9	—	—	—	—	0.96	0.99	0.80
8-A	—	—	—	—	0.68	0.82	0.87
3-D	—	—	—	—	—	—	1.38

Note: Nobel Amon Gelatin 40%, lbs per ton ore drawn.



GRIZZLY CHAMBER bears heavy weight and is completely concreted. Draw cone branch raises are also concreted.

40%, 8x1⅛-in. cartridges. Big pieces are first drilled with a light jackhammer making a hole 6- to 8-in. deep. Flatter rocks are sometimes plastered," covering the dynamite with mud. Big boulders that lie on top of the branch raises are drilled with stopers. Powder consumption is high and has increased during the last years. (See table). This is partly due to working blocks with harder material and partly as a result of the closely-maintained, 10-in. openings of the grizzlies.

In 1950, grizzly spacing was increased tentatively to 12 in., but difficulties arose at the crushers of the heavy media plant. If new crushers could be installed, opening the grizzlies to 12 to 13 in. would undoubtedly result in lower powder consumption and higher tonnage per man shift.

Originally, 60-lb rails were used for the grizzlies. Secondary blasting on the rails and falling of big boulders broke or bent the rails or at least the foot. This often ruined a grizzly the very first day after installation or repair. This resulted in hanging up of raises or big lumps entering the heavy media plant, which the crushers could not handle.

As consumption of rails increased and difficulties arose in getting them, a special grizzly bar of cast manganese steel was designed and made in the company's own foundry. These bars are 3½ in. wide on top with a variable depth and bottom width for greater strength. The cross section is 3½ in. square at the ends but the midpoint is 5 in. deep, 3½ in. wide on top and 2½ in. wide on the bottom. The length of a bar is 5¼ ft and it weighs 211 lb (see drawing).

BOARD FORMS have now been replaced by re-usable sections in drifts.

Although a few bars broke after a time due to porous casting, these bars have given excellent results as they are durable, keep the proper distance of 10 in. and require very little repair of the grizzlies. Similar 6½-ft bars have been cast in the foundry for grizzlies of the main ore passes throughout the mine and for the ore bins of the heavy media plant, where they last almost indefinitely.

Ground Support Is Solved

Maintenance of the grizzly levels is extremely difficult because of the relatively weak nature of the rock between veins and also wide empty stopes and faulted zones that have to be crossed. In Block 3A, two of the main crosscuts on the grizzly level caved in March 1952 and six grizzlies were out of commission, leaving the north-eastern quarter of the block practically dead and cutting off the whole ventilation of the block. To reopen these crosscuts, 12x12in. Oregon pine sets were placed close together. But after three or four trials this was abandoned as the timber crushed almost immediately.

It was then decided to use concrete. A horseshoe arch formed by a 60-lb rail was designed and constructed (see drawing). As the weight of loose rock on that crosscut seemed very high and more pressure from falling boulders was anticipated, the thickness of the concrete was made 3 ft. The form was made with wooden planks, tied to the rails with wire. Concrete was placed by hand. The first 6-ft of length cracked badly because it had to sustain the whole weight, but after the caved 30 ft were concreted, the first section was repaired and after six years is still open though badly mauled, the block having been worked out in the meantime.

For the grizzly chambers, a wider concreted flat arch cap-vertical leg railset was designed to give more space. It, too, has given good results. No less than 24 in. and in certain places 30 in. thick concrete is cast. The plank, eucalyptus or Oregon pine, is generally left in place in order to form a protective cushion.

In 1956, re-usable wooden drift forms were introduced and the rails were replaced by normal reinforcing, especially for long crosscuts. But for grizzly chambers the original rail and plank form was retained.

VERTICAL CRATER of Blocks 1 and 2 outline surface projection of undercut.

How Ore Calculations Compare With Mill Feed

	Cubication			Mill Feed			% Recovery	
Block	Tons	% Sn	Tons Sn	Tons	% Sn	Tons Sn	Tons	Sn
1	200,000	0.73	1,460	287,386	0.62	1,784	143.7	122.2
2	290,992	0.73	2,122	305,150	0.80	2,430	104.9	114.5
2A	232,449	0.71	1,647	93,607	0.74	689	40.3	41.8
2B	80,385	0.64	516	23,685	0.61	145	29.5	28.1
3A	1,066,914	0.97	10,305	1,061,643	0.83	8,794	99.5	85.3
5B&C	425,017	0.68	2,890	511,941	0.71	3,647	120,5	126.2
9	283,232	0.69	1,964	311,288	0.67	2,074	109.9	105.6
14	135,704	0.74	1,001	148,754	0.58	867	109.6	86.7
Total	2,704,693	0.81	21,905	2,743,454	0.74	20,431	101.4	93.3

Since 1952, 3,200 ft of horizontal workings have been concreted and not a single one has collapsed or has become unsafe.

Branch raises and transfer raises passing through old stopes or faulted zones are reinforced by rings made of heavy rails and a total of 1,020 ft have been lined with concrete. At times these branches had to be built up in open spaces.

Subsidence Is Vertical

During the first years of block caving practice at Catavi it was generally believed that the ground within an angle of about 60 deg from the undercut level to the surface would be affected by subsidence. Either it would cave into the block area or at least would be completely unsafe. And thus the reserves in this area would be lost.

Consequently, the desirability of block caving was strongly questioned by certain geologists who pointed out that especially deeper lying blocks would ruin extensive areas of the mine and would definitely wreck shafts and other workings in the neighborhood of these blocks. Fortunately these affirmations have proved to be wrong.

Strong blocks, such as 3A in the Animas area, have broken on vertical planes and have formed arches without caving to the surface. The Animas shaft, at about 410 ft from the block and supposed to fall within the range of the 60 deg angle, has not suffered at all. Other blocks situated in altered rhyolite and even faulted zones, have caved to the surface, but stayed within the marked area of the block. Where the blocks were close to the surface, deep craters have developed with vertical planes, though after several years these walls are sloughing in. (See photo above and at start of article.)

Some of the abandoned workings within the 60 deg angles have been reopened lately and the reserves are being taken out. Drifts close to worked out blocks, which had been closed as unsafe, have shown no cracks and have been reopened for traffic when necessary for access to other workings. Only in a few cases, when inclined stopes or faults dip into the block area, has any appreciable movement been observed.

Evaluate Three Components

Exploration of prospective block-caving areas is made by crosscutting and diamond-drilling. Early studies gave 30 meters as the minimum width for safely caving the rhyolitic rock and established 0.70% Sn as the cut-off grade. Evaluation considers three components: vein reserve blocks, old gob fills and solid waste.

Old gob fills are not sampled but arbitrary grades based on empirical data are assumed as follows: Fills made before 1937 at 1.40% tin; those from 1938 to 1945 at 1.00%; and from 1946 to the present at 0.50%. Specific weight of gob fills is taken at 1.7 which is probably too low because most fills are densely packed, but empty stopes in most cases compensated for his deficiency.

For solid vein material, sample grade is reduced by 30% and tonnage is increased by 10% to correct for dilution with barren rock. Grades of gob fills are corrected with a logrithmic standard chart, which indicates increased percentage reduction with increasing grade of material. At first, no correction was made on solid waste pillars between stopes, but, after production started, a 30% grade correction was also applied.

As a result of reducing pillar grade the calculated grade of the block caving ore was reduced to 0.61% Sn in 1950. But differences between assays at the Siglo XX mine and the Catavi mill showed this was too low and a new compensating correction of 0.02 points was applied. This also proved to be unreliable with increasing amounts of block caving ore and decreasing extraction from gob fills, and in February 1953 a new formula was adopted that distributes differences of tonnage and tin content evenly between solid veins, gob fills and block caving ore according to their contribution in terms of tin content in mill heads.

Comparison of in-place calculation and mill feed assay from exploitation of nine finished blocks is shown in accompanying table. Not included in the table are 341,677 tons of waste used for fill. The following observations will explain some of the data in the table: Block No. 1 was not completely calculated. The original data were lost. The block broke through to the surface; levels which were probably inaccessible and could not be sampled and included in the block, were drawn as ore, thus increasing the calculated tonnage. Block 2A (described later) had an odd shape and included a waste block which warped the results. Blocks 5B and 5C were taken together, according to exploitation data. Part of 5B had to be abandoned after a few months because of low grade of the northern cones, with a loss of cubicated ore.

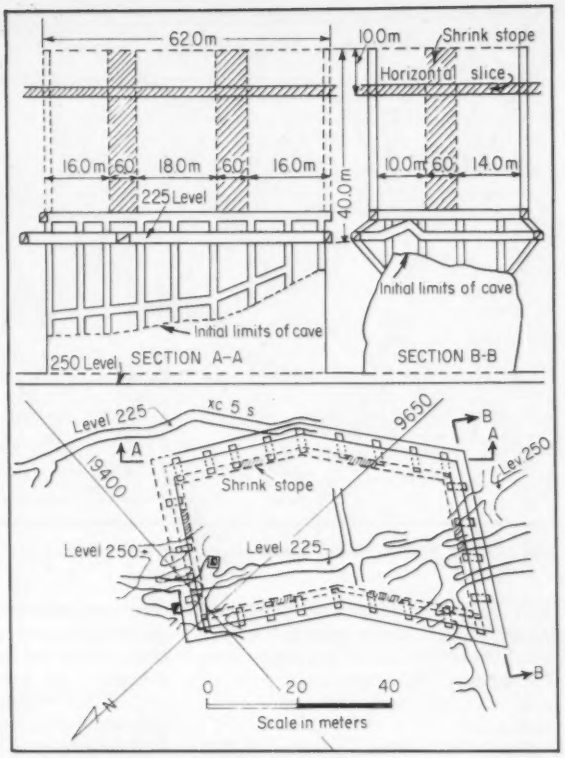
"SECURITY" SESSION, monthly in each block, aids safety.

Caving Had Fewer Accidents In 1957

	Total accidents	Working hours	Frequency	Lost days	Working shifts
Sections	1,831	6,247,032	293	78,319	780,879
Block caving	288	1,522,712	189	43,176	190,339

Note: Fatal accidents are considered as 6,000 lost days each. Sections have had 12 fatal accidents, block caving 7.

Cause	1951	1952	1953	1954	1955	1956	1957
Muck falling from raise	63	36	31	58	36	34	33
Blasting in cones	11	5	7	1	3	24	29
Blasting in raises	6	4	4	3	4	9	10
Blasting on grizzlies	8	3	3	5	6	9	3
Miscellaneous	2	4	—	2	2	18	8
Total	90	52	45	69	51	94	73
Frequency	12	7	6	9	7	12	9



EXTENSIVE ISOLATION was required to induce complete caving of the ore volume that had been planned for Block 11.

Costs, Personnel and Safety

Inflation, wage increases and artificial exchanges have vitiated all cost calculations from 1952 to 1956. Before 1952, preparation (i.e., block development) costs were not calculated on the same basis, as all workings on the extraction level were excluded. Cost records in 1957 show that preparation costs are about $45 per sq meter of block area, or $4.20 per sq ft. Exploitation (i.e., production) costs were $0.78 per metric ton from January to September 1957. For new blocks the over-all cost is $1.44 per metric ton at present time.

Powder consumption on the grizzlies was discussed earlier.

Personnel for block caving are as follows:

400 workers are occupied in exploitation in three shifts;

180 more are working in preparation.

Tons per man, including only productive personnel on the grizzly level, is 15 to 16 tons per man shift, but including all personnel of the block caving sections it is only 4.5 tons.

A bonus system has been introduced for the workers directly connected with production, the payment of which is frequently many times the basic wage.

Block caving has had a lower accident frequency rate than the vein stopes (see table). Fatal accidents have occurred when branches hung up and the miners climbed into the caving area in order to blast large boulders.

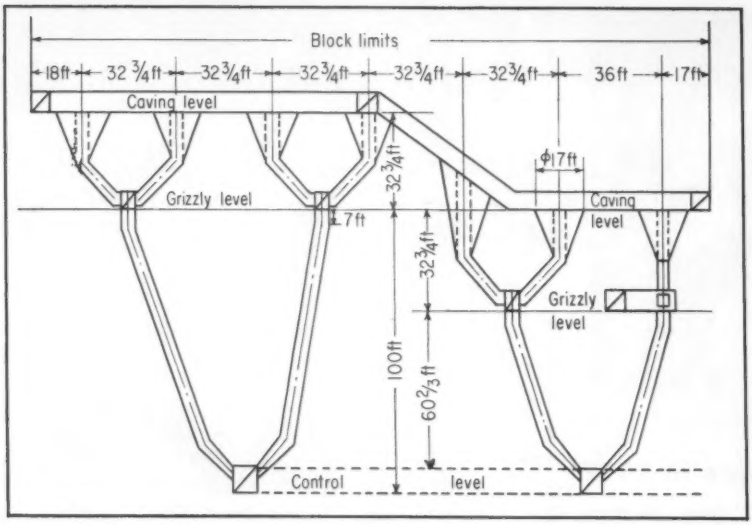
Most block caving accidents were caused by boulders falling from branch raises onto the grizzlies (see table). But concrete grizzly chambers have cut accidents as they provide ample space for the miners to get under cover in case boulders come down suddenly and also give complete roof protection.

Some Blocks Had Problems

Block 2A was one that should have been worked some other way. This block had a length of 180 ft and a width of 100 ft with an average ore height of 150 ft. Vertical extraction limits were assumed. A waste block of 83,000 metric tons was included, being intended to be drawn separately from the ore. (See drawing at start of article). However, this was not possible as the vein sections of the mine did not require as much waste for fill as had been anticipated and, on the other hand, ore from this block was needed for production. Thus before half the waste was extracted, the east side of the block was drawn rapidly and apparently the hanging wall of the Blanca vein broke in. Dilution rose so high that the block was abandoned after only 40% of the calculated tonnage had been drawn. Inclined caving and grizzly levels, following the foot wall of the mineralized zone, undoubtedly would have given better results.

When Block 11 was calculated, it was stated that "because of lack of enough old stopes in the area, this will probably not cave readily. But since the country rock appears to be fairly well shattered, little trouble should be experienced in the exploitation of the block." The country rock, a light-colored quartz porphyry and a brecchia cemented by quartz porphyry, was fairly solid and cut by numerous narow veins firmly cemented with pyrite.

Shrinkage stopes were taken up for about 75 ft and it was hoped that the rest of the block would break by itself. But once the block had caved to this height the block arched and did not cave further (see drawing). Only 58,000 tons out of a calculated 284,000 tons had been extracted and 226,000 tons of good grade ore remained. Therefore, new shrinkage stopes were raised to the upper limit of the block where the block was also cut horizontally. A total of 5,497 cubic meters (194,126 cu ft) in shrinkage stopes



INCLINED SECTION on levels solved problem of irregular bottom in Block 3G.

were necessary before the block was finally brought down with a big blast which destroyed the supporting pillars. Fortunately, this extra-work paid off with 244,000 tons of good block caving ore.

Block 3D covered an area of two or three normal blocks and seemed too large to be caved in one single block. (See table below and undercut drawing on a previous page.) Nevertheless, it could not be divided without leaving large pillars because the dry fill which could be expected after one block had been drawn completely, would run into the neighboring block more readily than ore from the caving block. This would cause the ore to be diluted excessively.

It was therefore decided to cave the whole block in one single unit, assuming that the greater weight would be carried by a greater area without increasing pressure per square meter. As the country rock was firm and only rarely cut by old stopes it was necessary to isolate it almost completely by shrinkage stopes, leaving only small pillars next to the manways. But the upper limit of the block was not cut horizontally. The block was then undercut and came down without incurring difficulties. The total tonnage of this block is 2,805,000 metric tons. Daily production has reached as much as 1,500 tons and can be increased to 2,500 tons when necessary.

Within Block 3D certain non-paying areas and waste portions had to be included. Therefore, preparations were made to permit separate drawing of ore and waste, the latter being destined as fill for neighboring stopes. Although the ore was to be handled by gravity raises directly to the main 650 haulage level, a control level was prepared to intercept these raises 100 ft below the grizzlies. This consisted of an existing level which had connections to vein areas where fill would be used. Chutes were installed on the control level, one for each grizzly or two cones because an early system of using one chute for several grizzlies resulted in an irregular draw when one cone became non-paying.

During exploitation, as the raises above the control level are filled, samples are taken on the grizzly. If the ore is of too low a grade, a trolley locomotive with 2-ton cars takes it to the vein sections for fill. When the ore is paying, the content of the raise is permitted to fall down through the floor of the control level. In order to protect the track and the concrete winze collars, a special car has been constructed which carries a wooden cone, 62 in. long and 50 in. wide at the top, and lined with rails. This car is easily pushed from one chute to another and prevents destruction of the collar and spilling of ore.

Block 3G is situated in the same contact zone of hard metamorphic rocks and disseminated cassiterite as 3D. The mineralized zone is irregular in shape. It appeared that a waste block along the bottom would have to be included to get an important volume of pay ore which would be lost if the undercut level were raised. Most of this difficulty was overcome by making partly inclined undercut and grizzly levels, with one part 30 ft higher than the rest. The grizzly chambers are horizontal but the main crosscuts which serve as access for men and material are inclined with steps made of masonry—a specialty of Bolivian miners. The preparation of this block has just been finished and it is not yet caved; but no difficulties are expected because of the inclined undercut level (see drawing).

Statistics on Block 3D Show It Is Unusually Large

Geology:
Altered rhyolite, brecchias, silicified metamorphic rocks; cassiterite in veins and disseminated; in Graciela, Victoria I, Victoria-Polvorin, Polvorin veins and ramifications; in Animas and Socavon Patino Sections.

Exploration:
Diamond drill holes for sampling—1574 ft; crosscuts old and new—7547 ft; total samples taken—1930.

Valuation:
Area—8.245 sq meters, approx. 110x75 meters (88,716 sq ft, 361x246 ft); Height—170 meters 558 ft); Volume—1,401,650 cubic meters (49,500,000 cubic ft).

	Tons ore (% total)	% Sn	Tons Sn (% total)
Vein reserves	29,318 (1.05)	2.93	859.23 (4.19)
Old gob fills	205,347 (7.32)	0.83	1,710.65 (8.35)
Solid waste	2,570,359 (91.63)	0.70	17,923.07 (87.46)
Total	2,805,024 (100.00)	0.73	20,492.95 (100.00)

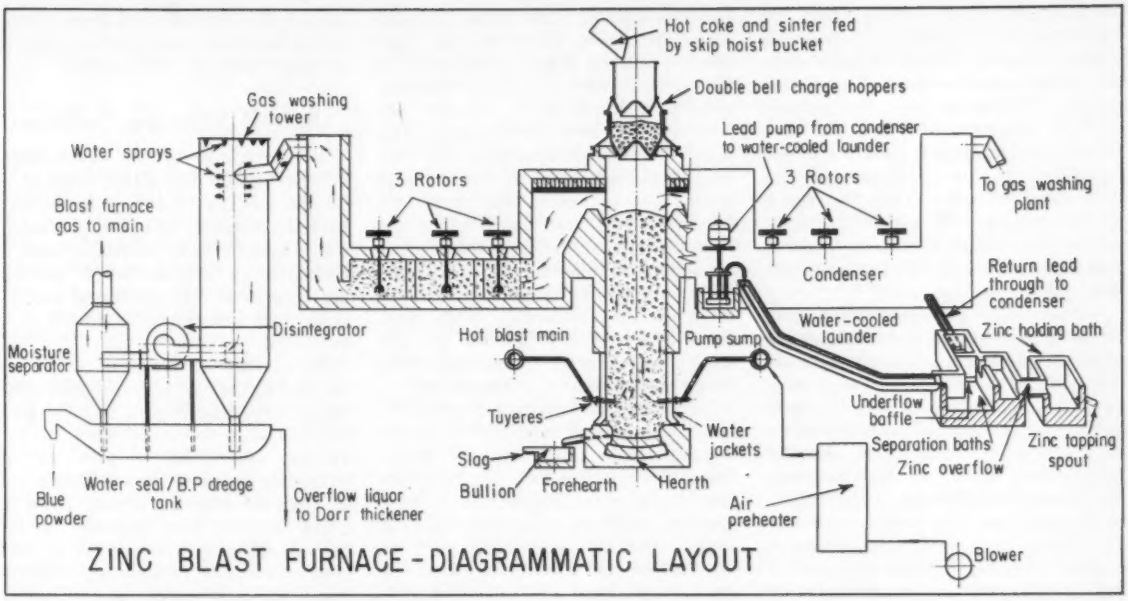
Ore gathering:
80 draw points 33 ft apart on level 436
44 grizzlies on level 446 (33 ft under caving level)
44 control chutes (100 ft under grizzly level)
28 transfer passes ending in 2 chutes on 650 level (510 ft under control level)

Preparation:

Horizontal	14,736 lineal ft
Vertical	12,054 lineal ft
Miscellaneous	1,008 lineal ft
Total	27,798 lineal ft

Lineal ft per sq ft of block area—3.19
Tons of ore per lineal ft—100.9
Isolation-shrinkage stopes—1,004,323 cubic ft

Time schedule:
Preparation started—July 1954; exploitation started—March 1957, expected to end—mid 1960.



AVONMOUTH ZINC BLAST FURNACE has shown that it can compete successfully with established methods of producing zinc from high-grade concentrates. It is unique in its versatile treatment of materials containing mixed lead and zinc.

Avonmouth Zinc Blast Furnace Demonstrates Its Versatility

S. W. K. MORGAN
S. E. WOODS

AN ACCOUNT OF THE WORK which led to the development of the blast furnace process for producing zinc and lead has been given elsewhere. In the present article the performance of the commercial furnaces operating the process at Avonmouth is described, with emphasis on the factors and controls, both at the furnace and the condenser, which experience has shown to be important for good metallurgical performance.

Two commercial furnaces have been built at Avonmouth. One was first operated in 1950 and has a hearth area at the tuyeres of 55 sq ft. The second furnace first came on line in 1952, and has a hearth area of 69 sq ft at the tuyeres. All the development work inevitable with the evolution of a new process of some complexity has been carried out on these two furnaces. In spite of the dislocation caused by this development work, the two furnaces have, between them, produced over 85,000 long tons of zinc and 13,000 long tons of lead, and have ranked for some time as definite production units.

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Description of the Furnace

The lower part of the furnace resembles that of an orthodox lead blast furnace, except that in the interests of heat economy and to obtain intensity of reaction in the hearth, separate tuyeres, projecting inside the line of the water jackets, are employed. Tuyeres are spaced at 16-in. centers along the long walls. Since the air blast is preheated (in alloy tube preheaters fired by furnace gas) the bustle pipes and leads are lagged; the tuyeres themselves are water-cooled. The upper part of the furnace consists of a brick-lined steelwork casing. Wear on the refractories in this section is quite unimportant.

Bullion, speiss, matte and slag are tapped in batches from the bottom of the furnace into a settler, where the phases are allowed to separate. Slag overflows from the settler into a granulating launder. The bullion is cast into ton ingots for subsequent refining. At present, speiss and matte phases are discarded, since the copper content of the materials treated does not exceed the amount soluble in the bullion, and is recovered by this means. Charges containing higher contents of copper are shortly to be run, and under these conditions recovery of the matte phase becomes important. There is no reason to doubt that a saleable matte can be made simultaneously with the recovery of zinc and bullion, and thus enable the furnace to recover zinc, lead and copper at the same time.

At the top of the furnace the gases enter two offtakes arranged symmetrically in the middle of each long side, and are handled in two condensers. An equal split of gases between the two condensers is arranged by automatic control. Since the furnace top operates under pressure, the charge is introduced through a double bell system, fed by a skip hoist. Weighed charges of sinter and of hot coke are added alternately. The coke is preheated to a temperature of 800 deg C in a vertical shaft fired by furnace gas.

Vapors leaving the furnace top are shock-chilled by a shower of molten lead in the condensers. These are brick-lined chambers in the bottom of which is a pool of lead. Three

vertical, electrically-driven rotors are immersed in this pool, and create an intense shower of lead droplets over the whole cross section of the condenser. The gases from the furnace passing horizontally through this shower are so rapidly cooled that re-oxidation by the CO_2 present has little time to occur. The zinc vapor in the gas condenses either directly into solution in the lead or to form liquid zinc which dissolves immediately in the lead.

Molten lead now containing zinc in solution scrubbed from the furnace gases is withdrawn continuously from the end of the condenser at a temperature of 550 deg C. It is pumped up into a water-cooled launder, where its temperature is reduced. As the temperature drops, the lead becomes supersaturated, and molten zinc begins to separate out and float on the surface of the lead. Sufficient cooling is applied to reduce the temperature of the lead to 440 deg C. It flows at this temperature into a settling bath, where the molten zinc collects as a layer above the lead. At the end of the bath the lead, now saturated with zinc at 440 deg C, flows under a weir (to retain the zinc) back into the condenser. It is then showered into the gas stream again by the rotors, and repeats its function of cooling the gas, and absorbing the zinc as its own temperature is raised again.

As the molten zinc builds up in the layer above the lead in the settling bath, it overflows into a holding furnace. There it is treated with sodium to remove traces of arsenic. It is then cast for sale.

The gas leaving the condensers, now stripped of over 95% of its zinc, is cooled in a water-irrigated tower. Any zinc or lead dust remaining in the gas is then removed in a Theissen-type scrubber, followed by a cyclone. The clean gas with a calorific value of 75-80 Btu per cu ft is used to preheat the air and coke used by the furnace. The remainder of the gas is used to fire low temperature furnaces in the remainder of the works, and any surplus is burned in boilers for steam generation.

Aspects of Furnace Operations

Requirements of good furnace operation are similar in many respects to those of other blast furnace operations. The unique aims of the process dictate, however, a distinctive metallurgy, combining features of both nonferrous and ferrous blast furnace practice with additional special requirements. There is an obvious resemblance to lead blast furnace operation in that in both cases a ferruginous slag is withdrawn from the furnace, together with liquid lead and matte or speiss. However, the lead smelter aims at fluxing zinc oxide in the slag and thus avoids the reducing conditions which are a primary objective in the zinc blast furnace. The high thermal requirements of zinc oxide reduction lead to features (necessity for preheated air blast, and for minimizing heat losses) which are characteristic of the iron rather than the nonferrous blast furnace. Naturally also, since the metal values recovered leave the furnace largely in the gas, there is particular emphasis on obtaining this gas free from impurities which would impair condensation.

The ideal charge is considered to be one consisting of coke and a metalliferous sinter containing the fluxes required for satisfactory slag composition. Local plant considerations may favor a departure from this type of charge, but at Avonmouth most of the fluxes and circulating load of drosses and blue powder is incorporated in the sinter. The limestone added at the sinter machine is somewhat less than the total requirement, however, so that a small addition of hard burnt lime remains to be made at the furnace for purposes of slag control.

Sinter Is Hard

In order to provide a lumpy feed to the furnace, it is necessary at the sinter plant to produce a much harder sinter than is customary in retort smelting. Hardness in the type of sinter produced at Avonmouth is associated with the presence of silica and lead.

Sinter hardness seems to be required in order to provide a sized furnace charge, rather than as an end in itself; the conditions inside the furnace as regards crushing and breakdown of sinter do not seem to be onerous, so that the criterion for satisfactory sinter is the sizing as charged to the furnace. Minus one-half-inch material is screened out before charging to the stock bins; a lump size similar to that of the coke, i.e., 2½ in. to 3½ in. is desirable. Study of the results obtained at different times with plant output sinters shows that too large a lump sinter size hinders elimination of zinc. Thus the objective is a sinter hard enough to yield sufficient sized sinter at the furnace, the preferred sizing being free from both fines (minus ½ in.) and coarse lump (plus 4 in.).

This type of sinter, with similar-sized coke, provides a charge with little tendency to segregate. Charge segregation, particularly if it is such that some tuyeres are smelting charge greatly different from the average sinter/coke ratio, can obviously affect performance, and it may be that, in fact, the type of sized sinter charge which has been developed is primarily of importance in this respect.

Updraft Sintering Preferred

In the course of the development at Avonmouth the sinter smelted at the furnace has been produced both by sinter-roasting of sulphide concentrates and by coke sintering, and in each case by both downdraft and updraft methods. The preferred method is updraft sintering of sulphide concentrates.

A number of types of coke can be used in the furnace, the preference being for a fairly hard metallurgical coke. The reaction between carbon dioxide and coke to give carbon monoxide leads to less effective use of coke for smelting arising from its effect on the heat balance of the furnace, so that too reactive a coke is to be avoided. In assessing different cokes the ash content is, of course, important. High ash content implies lower carbon content, and more of this carbon is required for melting the ash and its associated fluxes. In general, however, the process does not make stringent demands for coke quality, and fuels ranging from gas coke to hard foundry coke have been used at different times.

Coke is preheated before charging to the furnace in a shaft-type preheater with a countercurrent stream of oxygen-free gas, obtained by burning furnace gas in air. The breakdown of coke in this type of heater is not appreciable with the cokes used; with very soft coke it might be troublesome.

Since the furnace is linked to condensers the control of which depends upon a constant load, operation is carried on with constant air volume blown through the shaft, and not at constant bustle pipe pressure. Low or high furnace pressures may thus be of interest as a guide to furnace condition or the need for slagging, but do not, except in extreme cases, affect the quantity of coke burned per day. Characteristically, the back pressure on the furnace is less than it would be under the "stickier" conditions of a lead blast furnace, so that blowing rates are greater on the zinc furnace than on the lead blast furnace, but still much lower than in iron blast furnace practice.

The amount of zinc smelting "work" done by a unit of carbon is dictated by the heat balance of the furnace. The heat liberated per unit of carbon is, however, dependent upon the proportion of carbon dioxide to carbon monoxide in the offtake gases, which proportion, in its turn, is related to the balance of reactions in the shaft. The actual behavior is best regarded

as involving reduction of the metal oxides (and of sulphate oxygen) by carbon monoxide, so that the total carbon dioxide in the furnace gas is made up of a contribution derived from combustion, this being relatively constant, and one from reduction reactions which relates to the smelting duty performed. Increased air preheat temperature, or decreased heat losses from the furnace, result in a greater stock of heat available for endothermic reactions. The estimate given in a previous publication, that "carbon consumption may be calculated as the sum of 90% of the weight of zinc to be volatilized and 20% of the weight of slag formed," is conservative compared with current performance at the stated blast temperature of 600 deg C, and even more so, of course, compared with the possible air preheat of 750 deg C available with modern tubular air heaters. The air heaters now in service on the Avonmouth units were installed to give air preheats of 600 deg C (on one unit) and 650 deg C on the second; both units are now operated at more than double the original air volume, with some 50 deg C and more loss of maximum air temperature. As an approximate guide, an additional 100 deg C air preheat should enable a unit of carbon burned to perform 10% more smelting work.

Controlling the Slag

Conditions at the base of the furnace are such, when low zinc content slags are being produced, that some reduction of the ferruginous slag to produce metallic iron tends to occur. The resulting iron leaves the furnace associated with sulphide or arsenide in an iron-rich matte or speiss phase, of melting point substantially lower than the slag. Thus difficulties associated with high melting metallic iron are only encountered with severe over-reduction and can be avoided. A reduction in air preheat under such conditions provides a rapid method of relief, since with lower air preheat the hearth conditions are effectively less reducing. With charges based on high zinc-content ores, it proves quite practical to operate with slags containing only 3% zinc; when the zinciferous charge is of lower grade even lower zinc-content slags are practical. By increasing the amount of zinciferous charge per unit of coke, a less reducing condition is obtained, with higher zinc content of slag. The choice of the best operating conditions involves considering the relative economic importance of output and recovery.

Collection of values in matte or speiss has not been a practical problem to date with the charges smelted at Avonmouth. Increased copper content of raw materials would clearly pose this problem. Copper-rich matte and speiss have been produced in the large furnaces, and further work in this field is projected.

With the types of material available for treatment at Avonmouth, the composition of the sinter treated has been fairly constant over recent years, lying within the range Zn 42-46%, Pb 10-14%. Sinter at up to 18% Pb, 36% Zn has been treated on the large furnaces, and a wide variety of charges have been shown on the experimental furnace to be amenable to treatment. The effect of lead in the charge is to raise the carbon dioxide content of the gas by the amount equivalent to the reaction between carbon monoxide and lead oxide. Since this reaction is exothermic, the lead smelting makes no demands on fuel. Thus it is found that a given duty of zinc smelting can be carried out, with additional lead present, with no need for increase in fuel. It seems that the conditions at the furnace hearth, when there is a substantial lead fall, are an assistance towards maintaining smooth operation at low levels of zinc in slag. Present experience suggests that one can successfully treat charges containing lead up to equal weight with the carbon burned. In conjunction with a rich zinc-bearing material, this would correspond to about equal weights of lead and zinc or, with lower grade materials to substantially more lead than zinc. Examples of charges of composition very different from the standard, and which have been treated successfully, are as follows:

(a) Concentrates: analysis after roasting—23% Zn, 22% Pb, 48% gangue (of composition 43% FeO, 21% SiO_2)

(b) Concentrates: analysis after roasting—38% Zn, 16% Pb, 35% gangue (of composition 74% FeO, 3% SiO_2)

(c) Mixture of concentrates, tailings, etc. Analysis after roasting—20% Zn, 27% Pb, 46% gangue (of composition 34% FeO, 31% SiO_2)

Aspects of Condenser Operation

Experience of operations at Avonmouth shows that good condensation depends in the first place upon the furnace supplying a gas with minimum content of dust and fume. Dust in the gas depends upon the physical quality of the charge and upon the velocity of gas leaving the charge. By ensuring good quality charge and designing for moderate shaft velocity, the dust load is reduced to a level at which it is a minor contributor to drossing of zinc and lead. Metallurgical fumes, of compounds such as sulphides, arsenides and metallic lead, which are vaporized in the hotter regions of the furnace and largely recondensed as the gas leaves the charge, can result in serious dissipation of zinc into dross. One of the objects of good operation, therefore, is to ensure retention of such material in the furnace charge. This involves maintaining a sufficient depth of relatively cool charge on which to condense or filter, and in providing a chemical condition of charge so that such reactions with vaporized sulphides as

$$PbS(g) + CaO(FeO, ZnO) + C = Pb(l) + CaS(FeS, ZnS) + CO$$

can take place freely. The carryover of lead and sulphur from the furnace to the condenser is reduced to low proportions (less than 100 lb lead and less than 5 lb sulphur per ton of fuel) on lead-rich charges, though the mechanisms operating are not entirely clear.

Preventing Re-oxidation

The main remaining compositional factor is the CO_2 content of the gas which, of course, affects the re-oxidation reaction

$$CO_2 + Zn(g) = CO + ZnO$$

High CO_2 content of the gas is desirable from the point of view of ensuring efficient carbon utilization; in fact, the level of CO_2 in the gas has risen throughout the development. It is gratifying, therefore, that the condenser has proved extremely robust in this respect; gases containing up to 13% CO_2 have been satisfactorily condensed. It is probable that this ability to deal with CO_2-rich gases depends upon cleanliness from fume and dust. The re-oxidation reaction is one which takes place preferentially at solid surfaces, and the surface area exposed by fumes can be serious in this respect.

The action of the lead splash rotors is to produce a copious rain of lead droplets, as far as possible filling the gas space uniformly. The quantity of lead showered into the gas is large compared with the amount of zinc condensed. For a production rate of 1 ton zinc per hour on a condenser, there is a flow of some 400 tons of lead per hour through the condenser, and each of three rotors throws about 1,000 tons of lead per hour into the gas stream.

The condenser serves to transfer heat and zinc from the gas into the circulating lead. Abstraction of both heat and zinc from the lead takes place in the external cooling and sep-

Operating Data — No. 1 Blast Furnace Avonmouth

(12 Weeks From Feb. 2, 1958 to May 11, 1958)
All tons = 2,240 lb

	Wt tons	Tons zinc	Tons lead
Sinter, input new materials	6462.83	3130.73	746.13
Lead to condenser	239.45		239.45
Circulating dross and blue powder	1087.30	464.29	373.85
Total input	7789.58	3595.02	1359.43
Zinc output	2883.22	2841.97	41.25
Lead bullion output	904.23		904.23
Net lead output	664.8		664.8
Dross and blue powder (circulated)	1087.30	464.29	373.85
Slag	2785.0	202.80	22.35
Coke (burned, 85% C)	4054.78		

Time off blast	106 hours
Hearth area at tuyeres	55 sq ft
Blast rate	4900 cfm (ntp
Air preheat temperature	550 deg C
Analysis of zinc produced	Pb 1.1–1.3 %
	Cd 0.03–0.15 %
	As 0.001–0.003%
	Fe 0.015–0.028%
	Cu 0.001–0.005%
	Sn 0.005–0.015%

arating circuit. The quantities of heat and of zinc involved are such that lead entering the condenser saturated with zinc at 440 deg C (2.02% Zn) is withdrawn at 550 deg C containing an additional 0.24% of zinc, i.e., at 2.26% Zn. The water-cooled launders developed at Avonmouth have proved simple and relatively compact for the cooling duty they perform; the heat flux at the water-cooled surface averages 60,000 chu[1] (sq ft) (hr) and is as high as 150,000 chu (sq ft) (hr) at the hotter end. Operation of the condenser is controlled in terms of temperature, i.e., sufficient lead is pumped through the condenser for the stream at steady inlet temperature to leave at the desired outlet temperature. Correspondingly, the amount of cooling achieved in the launder must be such that lead entering the launder from the condenser at the target temperature is cooled back to the lower target temperature. This lower temperature is one at which some crusting of water-cooling surfaces occurs, so that the required cold lead temperature is to some extent maintained by self-adjustment, by adding to or melting the crust. An adjustment of the depth of water-cooled surface in contact with flowing lead is, in fact, sufficient to maintain good constancy of operating temperatures.

Removing the Arsenic

Some of the arsenic in the furnace charge is volatilized and enters the condenser. The bulk of this arsenic separates as zinc arsenide at the coldest point on the lead circuit, i.e., over the zinc in the separator bath. saturated with arsenic at about 0.04% As. This residual arsenic is removed by reaction with sodium metal. Both the arsenical dross obtained by sodium treatment and that separating in the lead circuit is returned to the furnace, the arsenic eventually being removed in slag and as speiss from the furnace.

A significant proportion of the zinc drossed is produced in the handling of liquid zinc in reheat baths, etc. This type of dross has little to do with metallurgical factors in the process, but reflects the exigencies of a plant in which the original planned output of metal has doubled. It is felt that reheating and holding baths would repay being heated by one of the modern system of induction heating.

The wet scrubbing system, through which the gases pass after leaving the condenser, comprising a countercurrent empty spray tower followed by a disintegrator, provides clean gas which is used both for preheater service on the plant (this uses about half the available gas), and for other purposes on the site. The blue powder settled out from the wash waters in a Dorr thickener is pumped to a rotary filter and semi-dried before return to the sinter plant. Dry dross arisings are screened into an oversize fraction returned directly to the furnace and undersize (minus 3/8 in.) delivered after moistening, but with no crushing, to the sinter plant.

Operating Results

In the above table, metallurgical data are presented covering the last twelve weeks of operation on No. 1 furnace—the most recent period at the time of preparing this paper. No. 1 furnace is the smaller of the two units at Avonmouth. The larger No. 2 furnace, and its ancillary equipment, is at present being further enlarged, and will be ready for operation again early in 1959.

For the first part of the campaign. blowing rate and coke burning rate were at a previously fixed standard. Following a planned increase in these rates, greater outputs were obtained and production during the later weeks averaged over 50 tons of metal per day.

Zinc Recovery

The recovery of zinc as a proportion of the new zinc charged is 90.8%. During this period, which is one of low metal prices, emphasis was on output rather than maximum recovery, and operation with zinc in slag equal to 6.5% of new input zinc was a satisfactory economic compromise. In this connection, and with the next item, carbon utilization, it should be noted that the air preheater on this furnace is now considerably overloaded, so that air preheat was only 550 deg C. A new air preheater will be installed capable of giving air preheat at 750 deg C; with this, each unit of carbon should be capable of performing 20% more smelting work. How much of the additional smelting capacity should be used in increasing output (by increasing the ratio of sinter to coke in the charge) and how much in increasing percentage recovery will have to be judged under the prevailing circumstances.

Carbon Utilization

The actual carbon consumption in the period was less than would be calculated from the expression quoted above, relating carbon requirement to zinc volatilized and slag melted. The calculated carbon consumption is 3,610 tons, compared with an actual figure of 3,445 tons (85% of 4,054 tons). This favorable result was obtained, despite the deficiency in air preheat already mentioned, and some unweighted recirculation of matte pot contents.

Lead Recovery

The net lead output quoted is the difference between the bullion tapped from the furnace, and the additions of lead made to the condenser. The addition required to maintain the condenser in balance is the difference between the amount dissipated in dross

[1]Centigrade heat units

and the amount volatilized from the furnace. Operation at low lead volatilization is favored to maintain good zinc condensation, and under these conditions make-up lead has to be added. The average lead content of the slag was 0.8%, corresponding to 2.7% of the new input. This figure is substantially higher than that attainable with good settlement, about 0.4-0.5% Pb. The settling arrangements are still in process of evolution, and some lead droplets are carried away in the slag.

It will be noted from the figures that, allowing for the lead present in the zinc sold, the recovery of lead was of the order of 94%. If more lead had been treated this figure would have been higher, since the lead losses in the circuit (in slag and unaccounted) are constant to a large extent and do not increase with increased production.

A typical analysis of the bullion produced is as follows:

Zn	0.02-0.05%
Cu	0.2 -0.6 %
As	0.01-0.04%
Sb	0.15-0.50%
Bi	0.01-0.03%
Sn	0.001-0.03%
Ag	15/14 oz/ton

During the period 82% of the small amount of copper present in the feed reported in the bullion. Due to the low copper tenor of the charge (sinter 0.04% Cu), the Cu:Pb ratio was such that the saturation solubility of copper in the bullion was not exceeded. To recover higher concentrations of copper it will be necessary to produce and retain a matte phase.

Dross and Blue Powder

A ratio of zinc in dross to blue powder equal to 12.5% of carbon burned has been regarded as typical of good practice. The data of the tabulated run give a somewhat higher ratio of 13.5%. About a third of the total recirculated load is blue powder, i.e., material which has passed on to the wet scrubbing system. This is partly due to zinc vapor uncondensed at the cold end of the condenser, partly to uncollected fume, etc. About one third is dry dross attributable to the condenser action, and the remainder zincy drosses attributable to oxidation in the liquid zinc section of the system.

The blue powder and zinc drosses are collected together and passed to the sinter plant to be incorporated in the sintered charge for the furnace. During the period under examination the total zinc content in these circulating materials amounted to 14.7% of the new input zinc.

General Operation of Furnace

The furnaces operate smoothly and consistently and present no difficulty in control. Once every 7 to 10 days they are shut down for eight hours to clear the condenser inlets, remove dross from the condensers and to carry out any maintenance work that is required. No difficulty is experienced in putting blast on the furnaces or taking it off. After a campaign of some 14 to 15 weeks, accretion in the furnace begins to affect operation. When this occurs the furnace in question is shut down, emptied and then any accretion removed. This requires an off-line period of four days. Approximately every 12 months a longer shutdown is required for repairs to auxiliary equipment, such as the air and coke preheaters. Sufficient experience is not yet available to enable an accurate assessment of downtime to be made, but during 1957 the total off-line time for No. 2 furnace for all reasons was equivalent to 47 days.

Building A Big One

The two furnaces in operation at Avonmouth are too small to show the full potential economies of the process. Construction has commenced at the Swansea Works of the company on a furnace to burn 94 tons of carbon per day with high air preheat. With this larger furnace operating, efficiency should be considerably increased, and production costs correspondingly lowered.

The target figures for a furnace of this size per ton of zinc produced are:

Coke requirement, containing 1.05 tons carbon
Other fuel requirements .30 therms
Power requirements ....285 kwh
Gas credit .....75 therms
Operating man hours 6.5

Work has also been started on the enlargement of No. 2 furnace at Avonmouth. The carbon burning capacity of this furnace will be increased to 75 tpd which is the maximum possible with the present roasting and ancillary equipment.

The blast furnace process for zinc production is still comparatively young, and still developing. It has already shown that it can compete successfully with established methods of zinc production for the treatment of high-grade concentrates. Clearly the process is extremely versatile in the type of materials it can treat, particularly those with mixed lead and zinc. Here the process has a special field of its own.

Reference: "The Production of Zinc in a Blast Furnace," S.W.K. Morgan. *Trans.* Institution of Mining and Metallurgy, Vol. 66, Part II, 1956-57.

LETTERS

Referring to an article by DeWitt Deringer, former general manager of Patino Group of Mines, which was published in your Journal, Vol. 159, No. 3, we, the engineering staff of the Corporacion Minera de Bolivia, deplore and refute the critical remarks of Mr. Deringer.

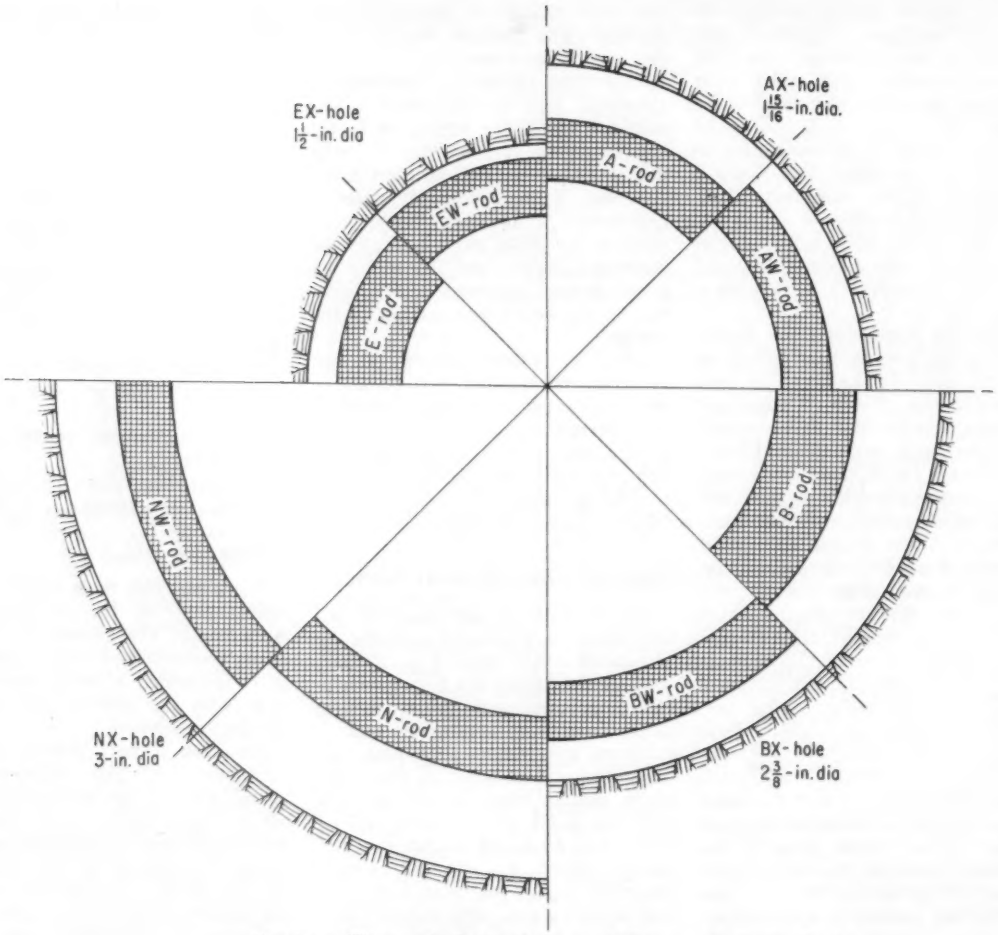
We find no fault in his observations on political conditions in Bolivia and its implications and refrain from making any comments on this subject. However, on technical matters he appears to have inadequate knowledge or has been ill informed. In these years there have been radical changes in the mine, mill and general economic conditions which have created new problems to be met.

More specifically, Mr. Deringer speaks of a barren rock from contact metamorphic deposits which in his opinion should be mined and treated separately. This phase of the subject has been studied carefully by the Geological and Mining Departments and found to be of minor importance and from a realistic standpoint not to be considered. As a matter of fact, no such attempt was made during his administration and no preparations were ever initiated to carry out such a plan.

Further, Mr. Deringer alludes to the limited perspective of the milling department in regard to the operation as a whole. But he did not consider the rapid exhaustion of the better grade vein ores which forced the mining department to rely more and more on ore supply from the very low grade block caving ores. The consequent drastic reduction in the grade of the mine ore forced an increase in mining and milling capacity to compensate for the loss in grade in order to keep up production. This was the primary object of the jig plant which was built at a very low cost and was paid for out of its production within a few months of operation without loss in metallurgical efficiency with an exceptionally low operating cost.

Concerning the slime plant, this is working only on a small scale with satisfactory results. The erection of a complete plant to treat the entire tonnage of our current sand-slime tailings had to be postponed pending improvement of economic conditions.

(*Continued on p 192*)



Section Through Drill Hole and Through Drill Rods

THESE SECTIONS through various size drill holes and diamond-drill rods are actual size. They conform to the nomenclature and standard sizes for diamond core—drill fittings specified by diamond drill equipment makers.

Names and Standards for Diamond Core Drill Fittings

PATRICK ADAMSON

THE ORIGINAL LETTERS E, A, B and N were used to designate the first series of diamond drill rods, core barrels, bits, water swivels and even machines; but the different sizes were not properly co-ordinated. In 1930, the newly formed Diamond Core Drill Manufacturers Association (DCDMA) wrote Standards integrating the four hole sizes using nesting casings. These were designated EX, AX, BX and NX to show that they deviated from the original four sizes, but belonged to the same group of core drill fittings.

Now, an NX bit and core barrel would go through an NX casing and drill a hole that would take a BX casing, and so on. The rods and water swivels were not changed and so retained the old E, A, B and N classifications.

Variations of core barrels were later developed, such as the M design with the core lifter in the inner tube. Here an M was added to denote that particular design, as EXM, AXM, BXM and NXM. The X was retained in the name to show that the X group of hole sizes was maintained.

Recently, the DCDMA and the Canadian Diamond Drilling Association (CDDA) jointly developed a new series of standards for drill rods that will give a balanced operation when used with X group of hole sizes. These were designated W to denote "World" standards and so EW, AW, BW and NW are now available. This will lead the way to interchangeability with equipment of foreign manufacture.

With the advent of the W series,

Mr. Adamson is with the Wheel Trueing Co. He acknowledges the assistance of Harry L. Kurtze, of the E. J. Longyear Co., in the preparation of this article. Diamond Core Drill Manufacturers Association has permitted the use of excerpts from their Standards Bulletin No. 2.

it was necessary to adopt nomenclature for core barrels with heads threaded for the W drill rods. Here the W replaces the X as the second letter in previous three letter designations and is inserted as a new middle letter in previous two letter designations.

The W designation thus is always the second letter; the first letter denotes hole diameter, and the third letter the group of hole sizes; thus EWX or EWM, and so on.

This is clearly set out in the DCDMA Bulletin No. 2, copies of which are available directly from the Association or from any manufacturer of diamond core drill equipment.

The Advantages of "W"

It is claimed that the "W" rods form a more stabilized drill string, reduce ID water friction, reduce vibration, lessen danger of cave, accelerate return of sludge and, by virtue of the three threads per inch connections, permit faster operation.

The inside diameters are standard and establish a minimum wall thickness. In the BW and NW sizes all rods are upset, thereby adhering to a maximum ID. In the EW and AW sizes some manufacturers furnish parallel wall rods.

Through standards, and by using the correct nomenclature, the user can reduce his inventory in the field; for he can order from the nearest distribution point and be confident that his needs will be clearly understood and that the equipment will fit what he already has at the job site.

Table of Nomenclature

Equipment	One-letter names	Two-letter names	Three-letter names
Drill rods	E, A, B, N Once standard but now superseded by W group.	EW, AW, BW, NW Current standards	....
Core barrels and parts	E, A, B, N Never standard and now obsolete.	EX, AX, BX, NX Once standard but now superseded by W group threaded for W group drill rods.	EWX, AWX, BWX, NWX Current standards—X design core barrels threaded for W group drill rods. EWM, AWM, BWM, NWM Current standards—Core barrels of M design threaded for W group drill rods. EXM, AXM, BXM, NXM Once standard but now superseded by W group of M design threaded for W group drill rods.
Casing	E, A, B, N Never standard and now obsolete.	EX, AX, BX, NX Current standards	....

Relation of Former E, A, B and N Rods, and of Present EW, AW, BW and NW Rods with EX, AX, BX and NX Hole Sizes

Hole size	EX		AX		BX		NX	
Drill rod size	E	EW	A	AW	B	BW	N	NW
Hole diameter, in.	1½	1½	1 15/16	1 15/16	2 3/8	2 3/8	3	3
Drill rod diameter, in.	1 5/16	1 3/8	1 5/8	1 3/4	1 29/32	2 1/8	2 3/8	2 5/8
Hole area, sq in.	1.77	1.77	2.95	2.95	4.43	4.43	7.07	7.07
Drill rod area, sq in.	1.35	1.48	2.07	2.41	2.85	3.55	4.43	5.41
Area of space between drill rod and hole wall	.42	.29	.88	.54	1.58	.88	2.64	1.66
Relation between area of space between drill rod and hole wall to area of hole in %	23.6	16.4	29.8	18.3	35.3	19.8	37.4	23.4

Bancroft Fights Low Copper Price and High Water Levels

BANCROFT, THE ILL-STARRED MINE of the Northern Rhodesian Copperbelt, will take its place in due course as one of the world's great mines according to Anglo American chairman, Harry Oppenheimer in his annual statement to shareholders.

Commenting on the fall in the price of copper and the difficulties which closed Bancroft, Mr. Oppenheimer said that whereas the strong and cooperative organization of the diamond industry and the financial strength of De Beers maintained stability and confidence in the diamond industry in the face of the U.S. recession, no such organization existed to protect the copper industry.

Anglo American was faced with an exceptionally difficult problem with Bancroft in which over $56-million had been invested when copper fell from the 1956 high to the present low price. It only recently had come into production and was just beginning to overcome the water and bad ground problems when the copper bottom fell out.

Anglo American closed Bancroft, but continued to do exploration and underground development in the vicinity of Kirila Bomwe shaft (No. 1). Stoping and hoisting at Konkola (No. 2 shaft) stopped in March and the shaft was closed.

Now, with the encouraging recovery in the price of copper, has come a resurgence of interest in the Copperbelt mines. And although there is little activity on the surface at Bancroft, work underground goes on at a pace sufficient to ensure that the available ore will enable the plant to resume production at least at the rate envisaged when the mine was originally opened in 1957. Shaft sinking on the orebody, where 92-million tons of 3.67% Cu were established, began in 1954. The property is capable of hoisting 100,000 tpm.

Developing footage continues to be encouraging despite earlier setbacks caused by water, chiefly in the lower levels. Crews are working on three shifts. Development on some levels has been in comparatively good ground and water pressures are dropping on all levels as the work progresses in the mine area.

Most of the Negro workers and their families have been returned to their tribal villages, reducing the nonwhite staff from 4,210 to 1,230. The number of Europeans has been sliced from 621 to 165. Bancroft will eventually resume production at a cost comparable to other Copperbelt producers, Mr. Oppenheimer concluded

SOLVENT extraction is essentially ion exchange—C. J. Lewis, manager.

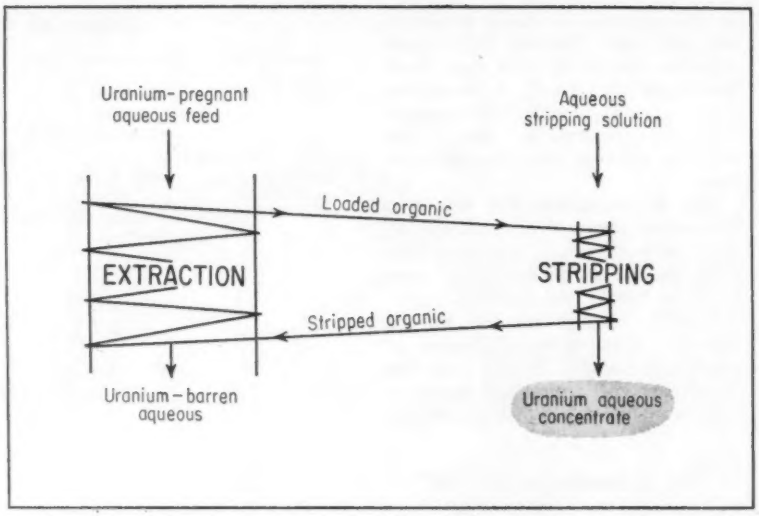


FIG. 1. ORGANIC SOLVENTS extract metallic ions from an aqueous feed and, in turn, are stripped of the concentrated ions by another, different aqueous solution.

Liquid-Liquid Extraction of Uranium

E. H. CRABTREE

C. J. LEWIS

LIQUID-LIQUID EXTRACTION used in uranium mills to produce an aqueous uranium concentrate from acid leach solutions is essentially the mixing and separating of two immiscible phases—the one organic and the other aqueous. Ions are exchanged between the two phases.

The system may be divided into five components. These are (a) the uranium pregnant aqueous feed, (b) the organic extraction reagent, (c) the organic reagent carrier, (d) the carrier additive, and (e) the aqueous stripping solution.

The principal function of the carrier is to serve as a diluent for the extraction reagent, thus obtaining maximum exposure of the reagent during its contact with the aqueous solutions involved. The purpose of a carrier additive is to assure that organics, intermediate in the reactions, remain soluble in the carrier and do not separate as a third phase. Both carrier and carrier-additive must be chemically inert, and highly insoluble in and immiscible with the aqueous solutions used. The organic extractant must be selective toward uranium, highly insoluble in both aqueous feed and aqueous stripping solution, and completely miscible in its carrier. Finally, the aqueous stripping solution must be capable of removing uranium from the organic extractant while at the same time conditioning or regenerating the organic extractant for recycle.

In the operation of the liquid-liquid extraction process, the uranium pregnant leach solution is intimately mixed with the extractant-in-carrier phase. The uranium enters the organic phase which is then allowed to separate from the aqueous phase by virtue of the immiscibility of the two phases. The uranium barren aqueous is usually discarded. The uranium loaded organic phase is then intimately contacted with the aqueous stripping solution which removes the uranium and becomes the aqueous

Mr. Crabtree is director, Colorado School of Mines Research Foundation, Golden. Mr. Lewis is manager, Chemical Division.

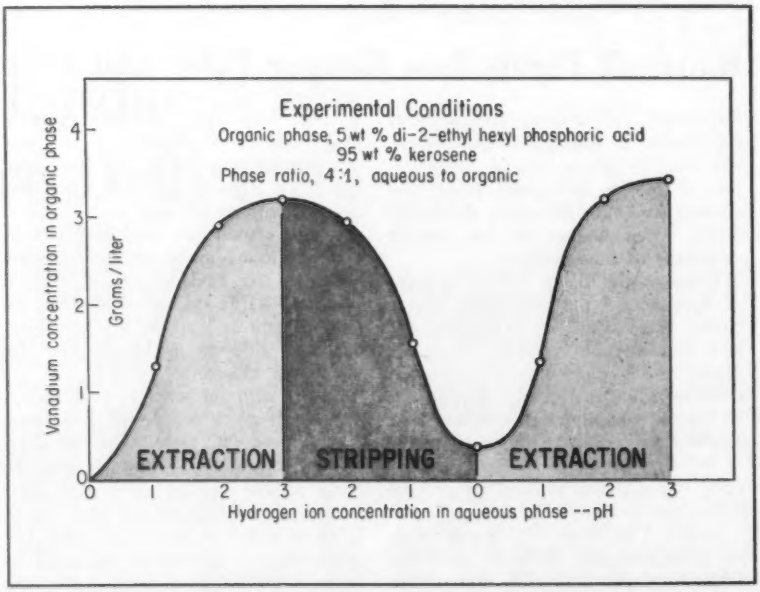

Experimental Conditions
Organic phase, 5 wt % di-2-ethyl hexyl phosphoric acid
95 wt % kerosene
Phase ratio, 4:1, aqueous to organic
Vanadium concentration in organic phase
Grams / liter
EXTRACTION
STRIPPING
EXTRACTION
Hydrogen ion concentration in aqueous phase -- pH

FIG. 3. HYDROGEN ION concentration appears to be a dominant factor in solvent extraction; by simply varying the pH, a solvent can be made to load or unload.

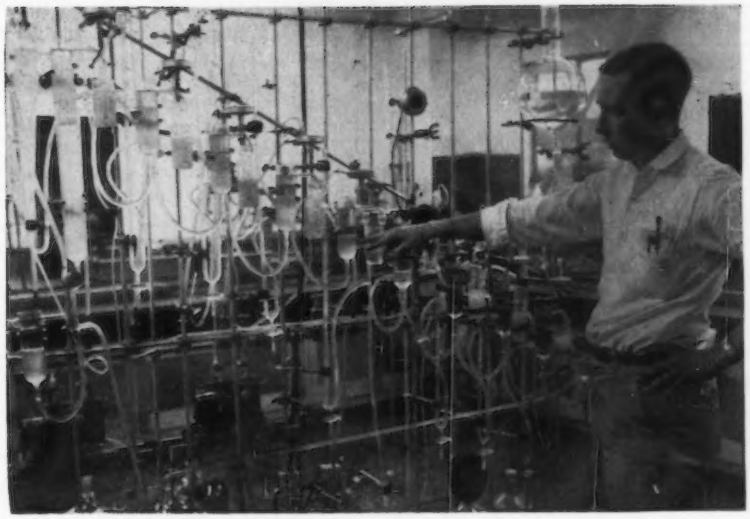


FIG. 2. CONTINUOUS mixer-settler liquid-liquid extraction systems can be studied on a small scale with laboratory equipment such as this used at Colorado Research.

From Aqueous Solutions

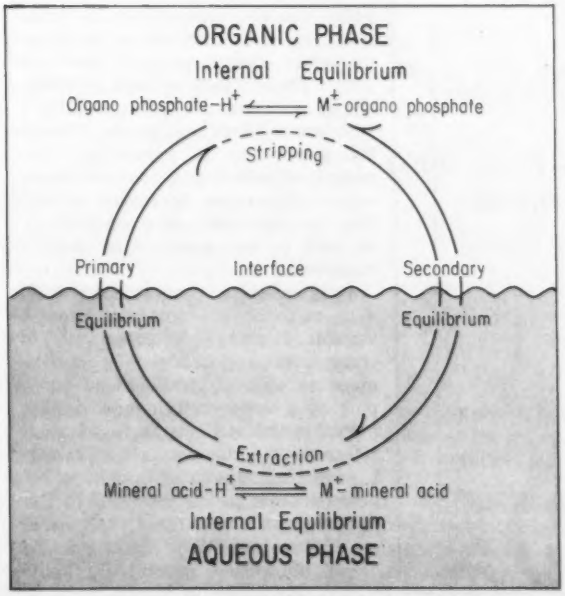
concentrate product. The stripped organic phase is recycled to the uranium extraction circuit. Since the volume of recycled organic phase is constant, whereas the volume of aqueous stripping solution may be from 1/20th to 1/40th that of the aqueous feed, very high uranium concentration is possible in moving from uranium pregnant aqueous feed to aqueous uranium product. Fig. 1 illustrates a schematic flow diagram of the process under discussion.

This liquid-liquid extraction is essentially an ion exchanging mechanism. Either anion exchanging or cation exchanging organic extractants may be used. Presently used anion exchangers are long alkyl chain secondary and tertiary amine salts; cation exchangers are represented by a group of long alkyl chain organophosphates. In uranium mill leach solutions, uranium apparently exists in an easily displaced equilibrium involving the uranium in both anion and cation forms. For this reason uranium is conveniently recovered from these solutions by either type of extractant.

It is therefore a consideration of items other than uranium which ultimately determines whether an anion or cation extraction system should be used. The most important of these, all of which relate to the uranium pregnant mill solution, are (a) suspended solids, (b) iron, (c) molybdenum, and (d) vanadium.

Neither type of extractant can tolerate appreciable suspended solids without serious loss of organic phase resulting from entrainment. However some amine extractants "collect" suspended solids which usually then accumulate at the phase interfaces in the extraction circuit. Such solids must eventually be removed from the system, thus begetting mechanical problems as well as resulting in loss of organic phase. Some amine extractants have a greater affinity for molybdenum than for uranium. This usually results in an amine-molybdenum third phase at the stripping circuit interfaces.

On the other hand, the amine extractants reject iron and other cations almost completely within the pH range common to uranium mill leach solutions. In contrast, organo-phosphate extractants do not "collect" sus-



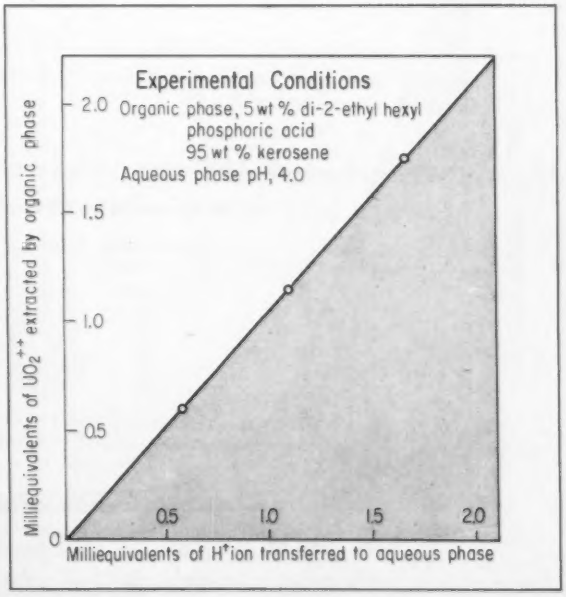


FIG. 4. AND 5. AN EQUILIBRIUM exists in an organophosphate system—for each equivalent of uranium cation extracted by the organic, an equivalent of hydrogen ion leaves the organic and enters the aqueous phase of the reaction.

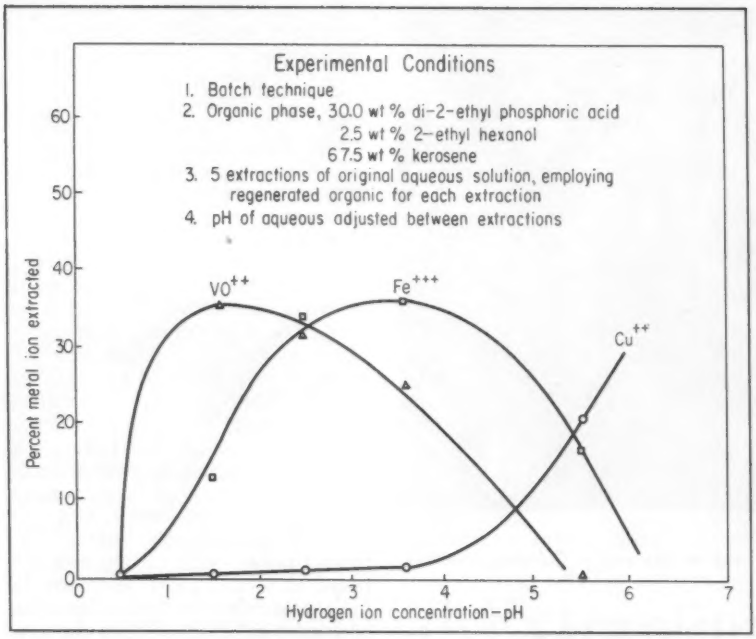

Experimental Conditions
1. Batch technique
2. Organic phase, 30.0 wt % di-2-ethyl phosphoric acid
2.5 wt % 2-ethyl hexanol
67.5 wt % kerosene
3. 5 extractions of original aqueous solution, employing regenerated organic for each extraction
4. pH of aqueous adjusted between extractions
VO^{++}
Fe^{+++}
Cu^{++}
Percent metal ion extracted
Hydrogen ion concentration—pH

FIG. 6. DATA indicates that in organo-phosphate systems, simple cations accompanying uranium may be selected in order of their increasing basicity by stages.

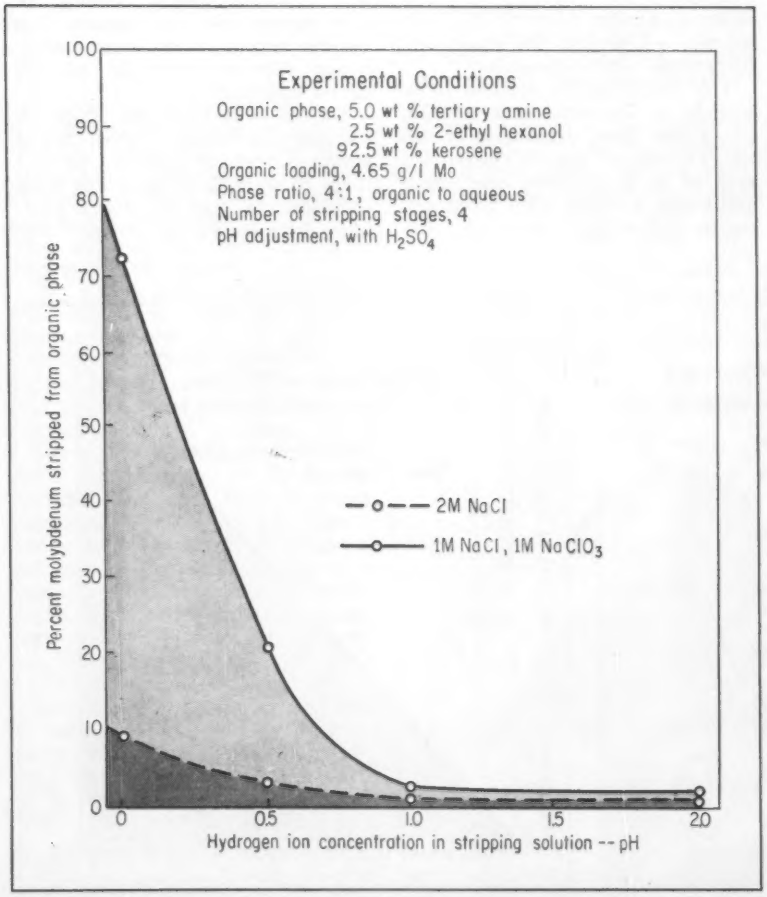

Experimental Conditions
Organic phase, 5.0 wt % tertiary amine
2.5 wt % 2-ethyl hexanol
92.5 wt % kerosene
Organic loading, 4.65 g/l Mo
Phase ratio, 4:1, organic to aqueous
Number of stripping stages, 4
pH adjustment, with H_2SO_4
2M NaCl
1M NaCl, 1M $NaClO_3$
Percent molybdenum stripped from organic phase
Hydrogen ion concentration in stripping solution -- pH

FIG. 7. STRIPPING molybdenum from a tertiary amine decreases with increasing pH. In these tests, NaCl-$NaClO_3$ was a better stripping agent than straight NaCl.

pended solids and have been successfully applied to feed solutions containing as much as 600 ppm suspended solids. Also, the latter extractants are less likely to encounter problems arising from molybdenum. However, they do extract other cations, some of which are always present in uranium mill acid leach solutions.

Among these, ferric iron is the most readily extracted, although the vanadium, thorium and molybdenum cation may also report with uranium. Fortunately ferrous iron is not readily extracted by organo-phosphates in the pH range of uranium mill leach solutions.

Either Anion or Cation

It is beyond the scope of this paper to discuss the many process variations which may be suggested by the foregoing brief observations. It is interesting to note that in experimental installations the system under discussion may be interchangeably converted from anion extraction to cation extraction by simply changing the type of organic extractant dissolved in the carrier. Fig. 2 illustrates a continuous mixer-settler liquid-liquid extraction system for small scale studies.

Many factors are common to both anion and cation extraction systems. Kerosene is presently the most popular carrier for both organo-phosphate and amine extraction reagents, and light fuel oils may also be used for either. Likewise, a number of carrier additives, of which 2-ethyl hexanol and diisobutyl ketone are typical, may be used in either system. While stripping solution composition is more likely to be tailored for a particular extractant, this is generally for economic reasons such as local availability of material, or for compatibility with materials of construction. From the standpoint of technology, uranium is effectively stripped from either organo-phosphates or amine extractants by the common mineral acids, as well as by solutions of sodium carbonate.

Hydrogen ion concentration (pH) appears to be the dominant process variable. For example, an organic extractant in a closed system may be made to undergo loading and stripping by a variation in aqueous phase pH only. This is shown in Fig. 3, with reference to the vanadium cation. Likewise, each type of system is believed to operate on the basis of ion exchanging equivalency. Possible equilibrium conditions existing in an organo-phosphate system are illustrated graphically in Fig. 4.

Repeated experiments indicate that for each equivalent of uranium cat-

ion extracted by an organo-phosphate, an equivalent amount of hydrogen ion transfers from the organo-phosphate and associates with the aqueous phase (Fig. 5). The amine system is more complex, in that the variety of anion species which may exist render it more difficult to determine the actual ion exchange. It appears reasonable to assume an ion exchanging mechanism, since the amine is regenerated for recycle as it yields its uranium content to the aqueous stripping solution.

On the other hand, each type of system has its peculiarities. The organo-phosphate system is chiefly characterized by its extraction of ferric iron. For this reason uranium mill solutions are usually reduced prior to uranium concentration by cation exchange. The selectivity of an organo-phosphate extractant for uranium and ferric iron, with variation in the oxidation-reduction potential of the aqueous feed, is illustrated in Table No. 1.

However, most cations extracted with uranium into the organo-phosphate system may be later separated by employing a sodium carbonate stripping solution. By this technique iron and other heavy metals are precipitated in the aqueous phase during stripping, which nevertheless leaves the uranium soluble as its carbonate complex.

Controlling Cations

The heavy metals precipitate can then be separated from the aqueous uranium product by filtration or other suitable dewatering process. Some data is available which indicates that in organo-phosphate systems, simple cations accompanying uranium may be selected in order of their increasing basicity by the technique of stage control of aqueous pH (Fig. 6).

With specific reference to the amine system, this is chiefly characterized by its rejection of ferric iron and its tendency to collect solids. Also, some amine extractants may become fouled with molybdenum in systems using stripping reagents otherwise suitable for stripping uranium. The desirability for highly clarified feed solutions for this system has already been mentioned; but the possibility of post-precipitation in some clarified feeds should also be borne in mind.

It is not necessary that ferric iron in the uranium mill solution be reduced prior to extraction by an amine system. However, special steps may be required for the removal of molybdenum loaded by the amine extractant. This will largely depend on the composition of the stripping solution used. In studying this problem as related to the use of both a secondary and a tertiary amine salt respectively, it was found that a stripping solution consisting of one molar sodium chloride acidified to pH 1.0 with sulphuric acid would not effectively remove molybdenum from the ura-

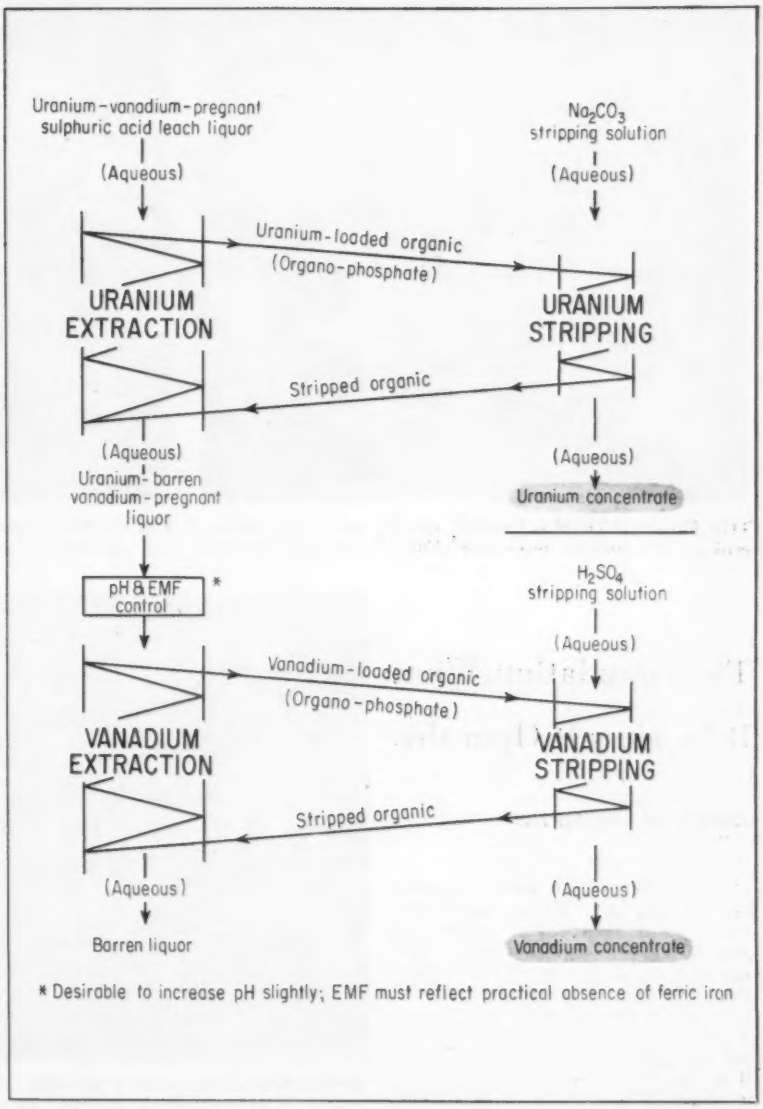


FIG. 8. THIS SOLVENT extraction process has been used commercially for vanadium and uranium. Methods for thorium and rare earths are available.

Table No. 1—Lowering the EMF Permits a Clear-Cut Solvent Separation of Iron and Uranium

		Aqueous solution analysis (grams/liter)		Percent metal ion extracted by organic phase	
pH	EMF (mv)	UO_2	Fe	UO_2^{+2}	Fe^{+3}
0.9.....	580	1.07	1.84	87.5	21.7
0.9.....	430	1.08	2.11	88.6	19.4
0.9.....	380	1.09	2.74	88.9	8.0
0.9.....	325	1.09	3.39	98.8	0
0.9.....	155	1.09	3.42	100.0	0

EXPERIMENTAL CONDITIONS—organic phase, 5 wt % organo-phosphate in kerosene; (2) phase ratio, 2:1 (aqueous to organic); (3) emf decreased with metallic iron; (4) pH 1, with sulphuric acid; and (5) temperature, 25 deg C.

THE FOUNDATION is handling industry projects in mining, geology and mineral processing—Edward Crabtree, director.

EXCELLENT research facilities and field-trained metallurgists are available to tackle flotation reagent or process problems.

The Foundation, What It Is, How It Operates

JAMES W. FRANKLIN

MINERALOGISTS examine hundreds of samples each month for prospectors and miners. If more complete analyses are needed, the Foundation has an assay lab.

COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC., located at Golden, Colo., is an independent corporation governed by a board of trustees and managed by a director, Edward Crabtree. The Foundation is related to the Colorado School of Mines only in that it has an interlocking board of trustees and rents the facilities from the School. It is able to use the services of faculty members, but practically all the Foundation's work is done by its 125 full-time employees, most of whom are experienced field men.

Four divisions—mining, ore dressing, chemical and business operations—have the assistance of the technical services laboratories which do all the analytical work and the technical information department which is responsible for editing and reproducing reports. In addition, a construction and maintenance department is available. Each department is headed by a supervisor, each division by division manager.

At the present time, F. L. Smith is manager of mining, F. T. Davis, manager of ore dressing, W. F. Anderson, manager of business operations and C. J. Lewis, manager of chemical division.

The Foundation does geologic studies and evaluates mines and methods. It does ore dressing and chemical work in nearly all the mineral commodities on the market—several of the present uranium mills were designed on the basis of the Foundation's research and pilot

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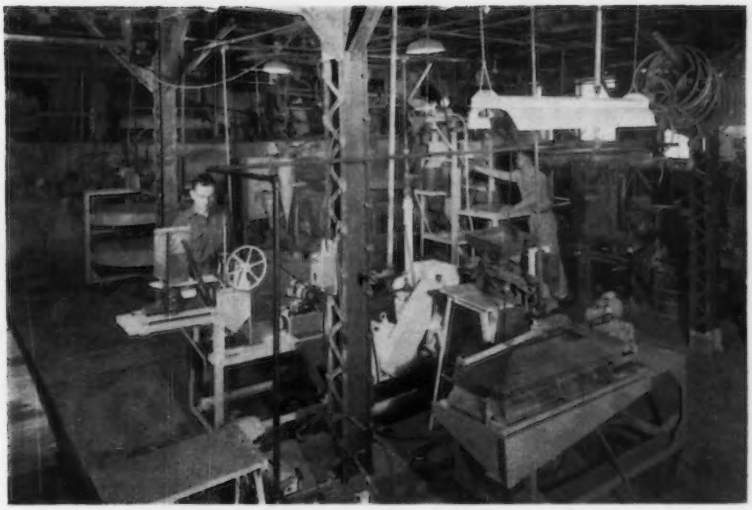
nium-molybdenum loaded organic phase.

The uranium was removed without difficulty, but molybdenum accumulated in the recycling organic to a degree which prevented efficient uranium extraction. Moreover, a green amine-molybdenum complex precipitated at the phase interfaces in the stripping circuit.

Further studies indicated that molybdyl molybdenum, rather than molybdate molybdenum was primarily responsible for this precipitation. Indeed, there was indication that impurities in the amine reagent were reducing molybdenum initially extracted in the molybdate form. It was established that when sodium chlorate was added to the sodium chloride stripping solution, the formation of the precipitate was prevented.

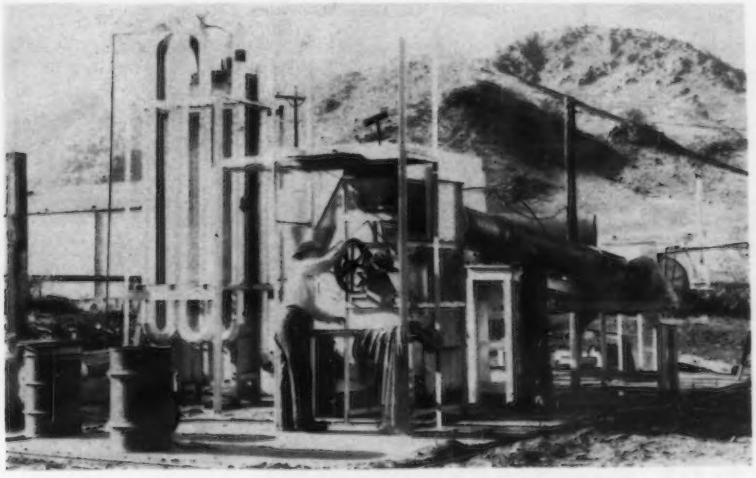
This oxidant in the stripping solution also resulted in improved molybdenum removal during stripping. Typical data resulting from this study appears in Fig. 7. However, difficulties arising from molybdenum behavior were not completely resolved by this procedure, for the molybdenum concentration in the recycling organic phase continued to progressively increase, although at a reduced rate.

It was found necessary, therefore, to scrub a small bleed stream of the organic phase, after uranium strip-



THERE'S no need for a client's own gravity concentration plant. The Foundation has available a wide variety of equipment for batch testing or continuous pilot plants.

ON A RECENT pipeline project, radioactive material determined pipe wear.



SHOULD a special piece of equipment be needed and purchased for the project it becomes the property of the sponsor, who may dispose of it as he wishes.

plant work. Mills as far away as South America have been designed, modernized or had their flowsheets changed by research conducted at Golden.

Contracts signed with mining, milling or chemical companies usually call for process research or development, but occasionally fundamental research is undertaken. After developing a process, the Foundation has frequently been asked to remain in a consulting capacity during design, construction and shakedown of the process.

The Foundation undertakes a project on an agreed cost between the sponsor and the Foundation, but never will the Foundation exceed that agreed amount. Charges are based on actual time-card cost of the personnel engaged, fixed overhead percentage, use of equipment and utilities. If special equipment is needed, the sponsor retains title to the equipment and may decide what to do with it after the program is completed.

Practically all the projects undertaken have been confidential, and on request the Foundation will apply for patents in the name of the sponsor. The Foundation does not undertake concurrent conflicting or competitive research and development projects.

An enormous amount of equipment is available as can be seen from some of the pictures shown here. Here are complete laboratory and pilot plant facilities. A sponsor does not need to spend the great amount of money to build and operate his own pilot plant—there are many already established at the Foundation—2,000 lb/hour flotation, two 100 lb/hour flotation, 100 lb/hour leach-filtration, continuous ion exchange, continuous solvent extraction, and all conventional gravity concentrating plants can be set up. Equipment is on hand for magnetic, electrostatic, crushing, grinding, and chemical processing studies.

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ping, with a 10 weight percent sodium carbonate solution. This operation, of course, removed all molybdenum from the bleed stream and by adjusting the quantity of the bleed stream it was possible to control molybdenum concentration in the organic phase.

The oxidation technique was subsequently improved by scrubbing the molybdenum-uranium loaded organic phase with an aqueous oxidizing solution. Both ferric sulphate and hydrogen peroxide were used respectively as oxidants in the aqueous scrub. Consumption of oxidant was almost negligible.

The liquid-liquid extraction system is completely hydraulic, its reaction rates are rapid, and its aqueous and organic phases are quickly and easily separated. For such reasons this system is amenable to chemical manipulations, process modifications and controls not generally applicable to comparable ion exchange resin systems.

For example, concentration of the extractant in its carrier may be varied over a wide range, and precipitation reactions may be conducted during the stripping operation. In addition, the organic "working phase" may be easily and efficiently transported.

By the close of the current year,

(Continued on next page)

Solvent Extraction

(Continued)

uranium mills accounting for approximately one-third of the uranium ore milling capacity in the United States will have liquid-liquid extraction circuits in operation. Moreover, this will represent about 50% of the milling capacity subjected to the acid leach process. It is the consensus of those now responsible for the operation of these circuits that the liquid-liquid extraction process has the following advantages as contrasted with the comparable ion exchange resin process:

a. Lower capital investment.
b. Smaller space requirement.
c. Minimum reagent inventory.
d. Less operating attention.
e. Greater process flexibility.

On the other hand, liquid-liquid extraction process is vulnerable to the loss of organic reagents as the result of their aqueous solubility or from their entrainment in discard liquors or solids leaving the process. Also the process has not yet been successfully applied to the recovery of uranium from its alkaline leach liquors, or from uranium solutions high in suspended solids, such as pulp slurries. In addition, liquid-liquid extraction is at a disadvantage as compared with column ion exchange in cases where concentration of uranium in the acid leach solution is relatively low. This is because the loss of organic reagents is chiefly a function of the aqueous volume of feed solution processed rather than of the quantity of uranium concentrated.

However, the progress which the liquid-liquid extraction process has made in uranium milling forecasts new developments and uses.

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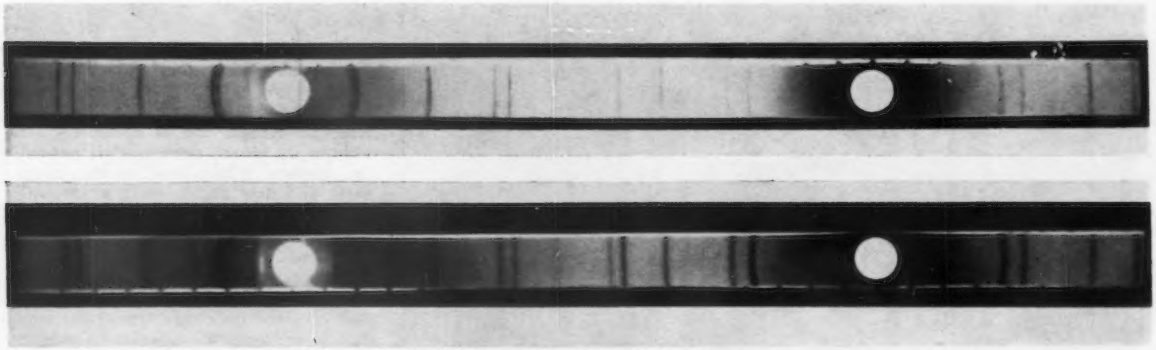

UPPER X-ray diffraction pattern was obtained from gold-wire sample. Lower pattern was obtained from black parting residue sample. Identical nature of the two patterns shows that residue is crystalline in structure, not amorphous as once held.

Tests Show That Gold Parting Residue Is Not Amorphous

E. A. PERETTI

THE WELL-KNOWN quantitative analysis of ores and bullion for their gold and silver contents terminates in the production of a gold and silver alloy or "bead" which is weighed and then "parted". That is, the gold and silver are separated by dissolving the silver in dilute nitric acid. The gold is insoluble and remains in the parting cup as a black residue. After several washings the residue is dried, annealed at a red heat, and then weighed. Annealing changes the color of the residue from black to gold-yellow.

Mr. Peretti is head of the Department of Metallurgy, University of Notre Dame, Notre Dame, Indiana.

Several textbooks on fire assaying state that annealing either changes the allotropic form or transforms the black amorphous condition to the yellow color of crystalline gold.

That neither of these statements is true can be proved by X-ray diffraction. Several alloys were prepared by melting together commercially pure gold and silver so that the gold content varied from 2 to 5 atomic percent. The black residues from the acid treatment were X-rayed, using copper radiation with a nickel filter. Typical photograms are shown. All patterns of the black residue were like the one shown in the lower portion of the illustration. This allows us to conclude that the black residue is not amorphous, but that it consists of crystals with the face-centered cubic lattice of gold.

The photograms of annealed gold showed, of course, the same space lattice, so no allotropic change is involved upon annealing. It was noted that the apparent volume of the black residue was several times that of the original gold added. This fact, coupled with the broad lines in the X-ray patterns of the unannealed gold, seems to point to the conclusion that the residue appears black because of the very small crystallites that form as the silver is dissolved from the silver-gold solid solution. Annealing merely sinters the highly active crystallites into larger entities.

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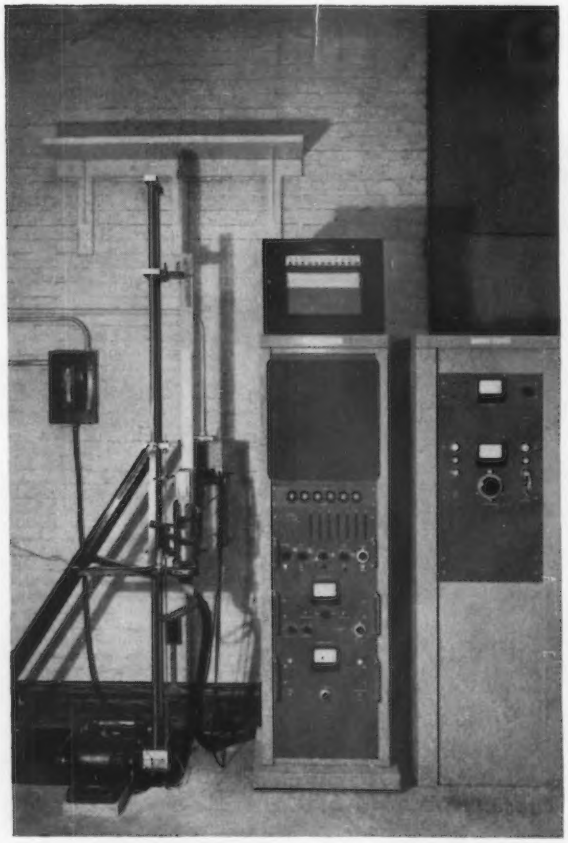

FIG. 1. X RAYS are used to measure, evaluate the suspended solids concentration of a liquid or slurry at any given time.

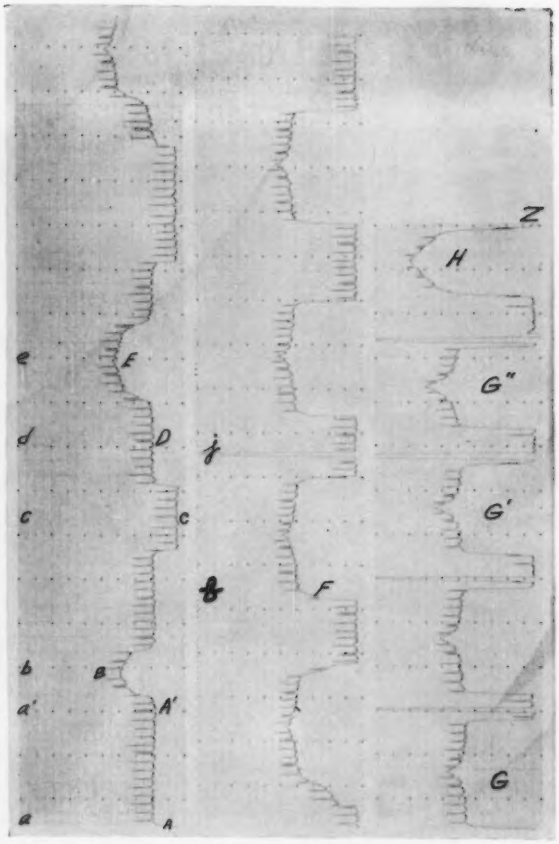

FIG. 2. RATE METER evaluates the X-ray transmission through the pulp, then records results on a recording drum.

The Transviewer—X Rays to Measure Suspended Solids Concentration

A. M. GAUDIN
M. C. FUERSTENAU

A NEW TOOL, the Transviewer, that enables metallurgists to determine the concentration of solids in suspension at any given time, and the position of the measurement in a settling pulp without disturbing the system, has been developed at Massachusetts Institute of Technology's mineral dressing department.

Basically, the apparatus consists of a source of X rays, and devices that evaluate, average and record the X rays transmitted, as a function of time, together with a scanning mechanism that permits movement of the object of study with reference to the source of X rays. Fig. 1 is a photograph of the apparatus.

To the left appears the frame on which the settling vessel is mounted. At the bottom are the motor and speed reducer which drive the settling vessel. The X-ray tube is permanently mounted in a fixed position between the observer and the settling vessel. Behind the settling vessel is the end-window radiation counter. In the center is the cabinet housing the scaler, rate meter, and the voltage control for the counter; it is topped by the charting element consisting of a paper-covered drum on which an inscribing pen records the transparency to X rays as a function of time. To the right is a second cabinet housing the parts concerned with maintaining constancy in input to the X-ray tube.

In the device that has been realized so far, the settling vessel is moving and the X-ray equipment is stationary; it is, of course, possible to achieve the same ends by keeping the object stationary while moving simultaneously the X-ray source and the counter tube.

Application of high-absorbing markers such as lead strips to the outside of the settling vessel permits definite localization of the transparency measurement that is recorded on the chart roll, which can also be correlated with time. Accordingly, then, the measurement that is made is known as to time and position.

Standard measurements with stationary suspensions permit calibration

Dr. Gaudin is professor of mineral dressing, and Mr. Fuerstanau is research associate, Massachusetts Institute of Technology, Cambridge, Mass.

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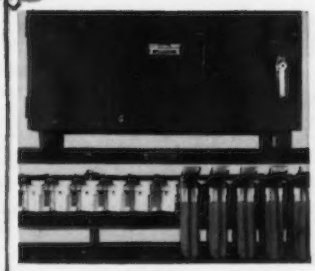

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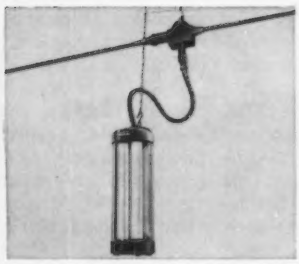

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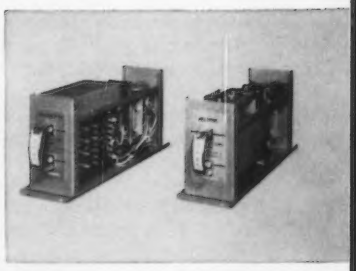

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of observed transparencies, so that the intensity on the recording roll can be translated into percentage solid in the suspension under study.

In one application of this instrument, a suspension of clay in water is placed in a glass cylinder capable of moving upward or downward at a constant, adjustable rate and of automatically reversing its direction of motion when it reaches the end of a pre-determined linear path. The X-ray beam is collimated and the evaluating tool for measuring the X rays transmitted consists of a Geiger-Mueller end-window counter. This counter is connected to a scaler and from it to a rate meter. The evaluation of the rate meter is inscribed on a recording drum covered with paper and moving at a constant but adjustable speed. Fig. 2 illustrates the type of results that are obtained when the device is used in this manner.

The record in Fig. 2 begins at A and ends at Z. In this figure the time scale is vertical and the pulp density scale is horizontal. Initially, the pulp throughout the tank had the transparency denoted by the abscissa corresponding to the flat trace AA′. By the time the bottom of the vessel is being inspected, at time b, it is clear that a mud thicker than the original mud had formed with maximal opacity corresponding to the abscissa bB. At a later time, c, the top of the column is under inspection. This turns out to be clear water (abscissa cC). When the scanner is in its second cycle there are three layers: the water layer at C, the initial mud layer at D (with transparency dD equal to aA), and the bottom mud at E with somewhat gradationally varying transparency (eE).

Further cycles show that the initial mud disappears at time f, and that the bottom mud develops a gradually accentuated region at the very bottom, of higher and higher absorptive quality (G, G′, G″). Ultimately the bottom mud acquires a steeply graduated absorptive character as may be seen at H. This chart represents a continuous record up to time j, with interruptions thereafter at the end of most cycles. It is of interest to note that the boundary between the initial and bottom muds is as sharp as that between water and mud; yet such a boundary is not visible to the naked eye (this pulp contained no "sandy" portion).

In the application described above, the settling vessel has been a 2-in., 4-in. or 6-in. glass tube, in some cases equipped with plane-parallel polyethylene windows to reduce the X-ray absorption due to the container. It is not necessary to use a glass-walled vessel; any structural material for the vessel is acceptable providing its opacity to X rays is not large compared to the opacity of the suspension under study.

Although no thicknesses greater than 6 in. have been tested so far, the existing apparatus should be capable of dealing with distances through aqueous suspensions of the order of 8 to 12 in. and through much greater distances in suspensions of solids in air or other gases. By using more penetrating X rays, greater distances could be dealt with, and it may be imagined that the device could be applied to rather highly absorbent columns of material of considerable thickness.

Instead of clay suspensions that are settling without water current, it is entirely possible to carry out the measurements in a suspension through which a liquid current is provided, or to make the measurement in a suspension in air or in other gases. It is also possible to make measurements in a suspension that has been given some kind of reciprocating motion as in jigging. In that instance, it may be preferable to make the measurement only at certain instants in the jig cycle. This should be attainable by placing a shutter between the source of X rays and the tank and by synchronizing the motion of the shutter with the jigging cycle. Thus, the Transviewer should be capable of application in the study of classification (either aqueous or pneumatic) of fluid-solid systems, of dust-collection systems, of jigging, of mixing vessels, of flotation pulps and froths, and of foams. In general, it should find applicability wherever unstable polyphase suspensions require study or control.

The instrument realized so far provides scanning in one direction only. It is clear that two dimensional scanning can also be used, thus permitting application to systems having lower symmetry than the systems considered so far.

The authors wish to acknowledge with thanks the support provided toward the realization of the Transviewer by the Engineering Foundation. the U.S. Atomic Energy Commission, (Crucible Steel Co., Duval Sulphur and Potash Co., and Georgia Kaolin Co.). The authors are grateful to Professors J. T. Norton and R. E. Ogilvie of Massachusetts Institute of Technology for their assistance during the early stages of this development.

How to Grease Induction Motor Bearings

SINCE BEARING FAILURE is one of the principal reasons for induction motor breakdown, proper maintenance and lubrication are very important—careless lubrication can cause insulation deterioration from oil leakage, as well as bearing failure, which may allow the rotor to rub against the stator.

According to J. W. Samzelius, motor engineering dept., Westinghouse Electric Corp., Buffalo, N. Y., in *Maintenance News Vol XXI, No. 2,* here are some suggestions for proper lubrication procedures.

Prelubricated and sealed bearings should not have grease added or the seal opened in the normal service life. Regular bearings, on the other hand, must have periodic lubrication if they are to give dependable service. When shipped from the factory, motors with regular bearings will usually be packed with only a limited amount of grease.

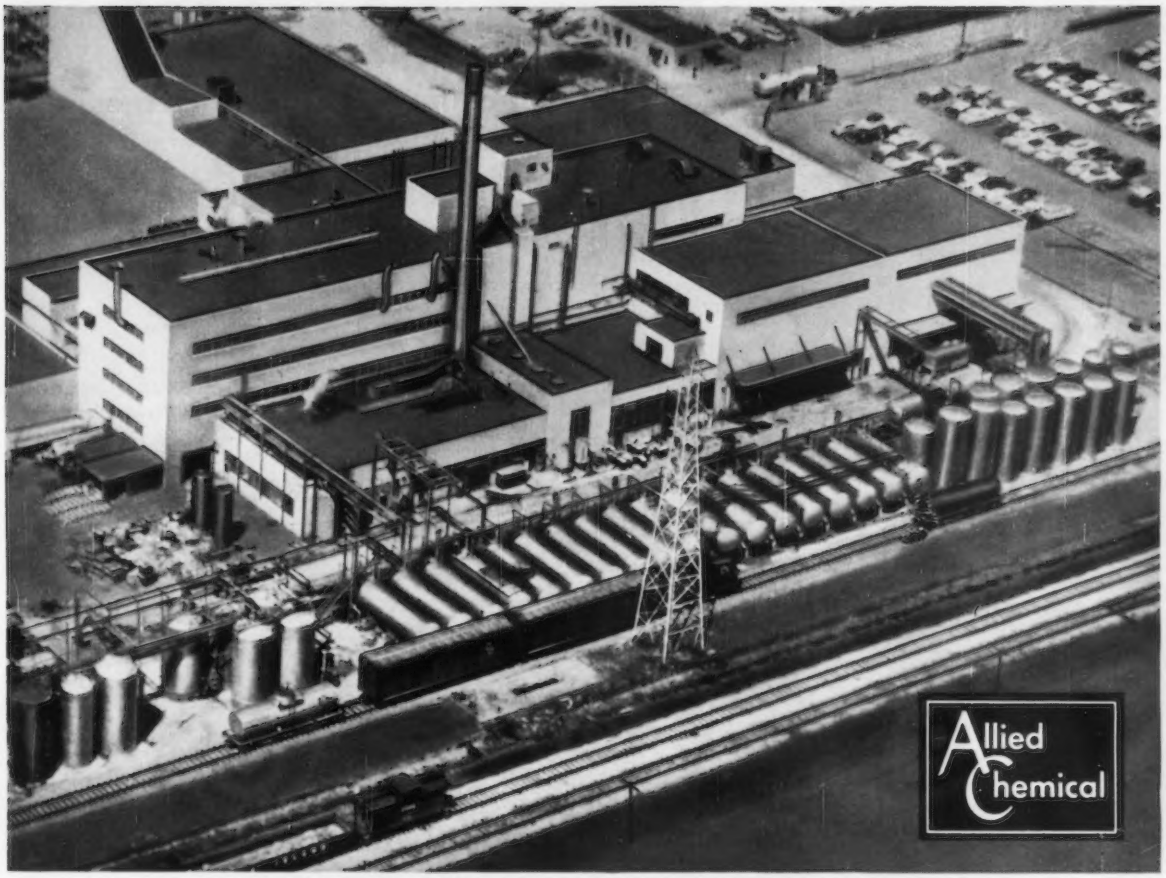
A grease change should be made soon after the motor is put into service, and at suitable intervals thereafter. In general, keep the bearing housing ⅓ to ½ full, with shaft sizes up to 3 in. dia, and from ½ to ¾ full on larger sizes. When possible, new grease should be added with the motor at rest. If the bearing housing has a sump for excess grease, the sump must never be permitted to fill completely.

If the housing has only a drain plug, open the plug when adding grease, and leave it open for a short running period afterwards.

Add grease after every three months of operation according to the following schedule, with this reservation—if the schedule results in a surplus of grease in the bearing, reduce the quantity added or lengthen the time between additions—

Shaft dia (in.)	Grease (cu. in.)
¾ to 1¼	1
1¼ to 1⅞	1¼
1⅞ to 2⅜	2½
2⅜ to 3	4
3 to 4	7
4 to 5	10

Do not use ordinary cup greases for lubrication; these will deteriorate under the severe churning action of the bearing. Instead, use a grease especially made for industrial ball and roller bearing motors.



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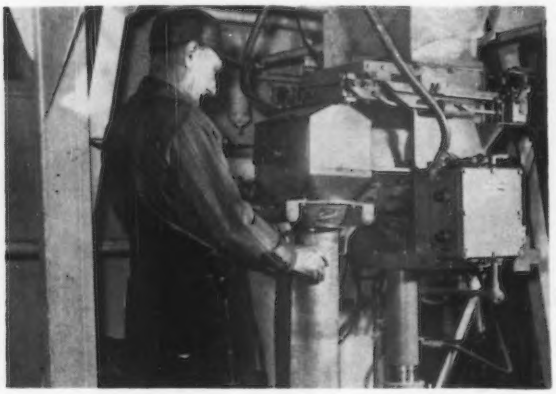
OPERATING IDEAS



Machine Now Packs Explosives

AMMONIUM NITRATE EXPLOSIVES are now being automatically packed at the United Electric Coal Co.'s Fidelity mine, Du Quoin, Ill. According to the Bemis Bro. Bag Co., this is the first use of its Packer-Ette for explosives, and the first known use of a commercial bagger for packing explosives at the mine level.

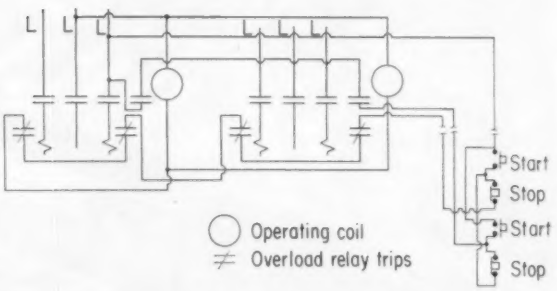
United Electric packs its explosive (Unimite) in polyethylene bags, Bemis waterproof laminate-textile explosives bags and tin cans. The heart of the operation is a two-level packing shed. The upper level contains two large stainless steel mixers where the basic ingredients of the explosive are mixed. Each mixer feeds into a packer on the shed's lower level.

The Packer-Ette will fill a bag or can in only eight seconds, and, Bemis claims, has resulted in substantially increased production. Capacity of the machine ranges from 25 lb to 150 lb and a simple adjustment determines the weight packed.

Circuit Scheme For Duo-Shutoff

HERE IS AN ELECTRIC CIRCUIT which has been found to be useful around mines and mills. It is used when two motors must gather as one—on pumps that are working in series, fans and conveyor belts in series, or on any other setup where one unit must stop if the other does.

The two linestarters are hooked in parallel with the overload trips in series. The diagram shows linestarters operated from two places by start-stop push buttons—float control or other automatic control may be used as well. Circuit was submitted by Dick May, Box 681, Wallace, Idaho.



Handle Reduces Coupling Hazards

A SIMPLE BUT EFFECTIVE device to eliminate accidents while mine locomotives are being coupled to car has been developed at the Bunker Hill Co.'s mine machine shop at Kellogg, Idaho.

Pieces of 3½-in. diametered shafting are fitted in an upright position inside a standard 8-in. connecting link and then welded into place. Channels are first burned in the side of the shafting with a cutting torch, so that it will fit firmly inside the link, but without distorting link's shape. A loop of steel is then welded on top of the scrap shafting to act as a hand hold. By holding onto this handle, instead of the connecting pin, the motorman's hands are always in a safe position.—*Safety Newsletter,* Mining Section, National Safety Council, Chicago, Ill.

New Diesel Fuel Cuts Down Odor

BY FINDING A REPLACEMENT for the regular diesel locomotive fuel used at Wyoming's Fremont Canyon project, engineers of Coker-Kewit-Cunningham Construction Co. were practically able to eliminate troublesome underground exhaust gases.

The company is engaged in building a three-mile diversion tunnel which will carry water from the Pathfinder Dam to a nearby hydroelectric plant and then on to a reservoir. The locomotives (four DRXC Hercules diesels) operate at high altitudes and low temperatures and, though they produced little or no monoxide gases, other gases emitted from the exhaust system caused considerable trouble to tunnel workers.

Tests showed that a white kerosene-Marvel Mystery Oil mixture (55-gal Marvel drum to every 5,500 gal of kerosene) was clean burning and produced no objectionable odors or gases. Locomotives are currently operating on a 24-hr day, six-day week. Since the new fuel was put into use, each engine has had better than 3,000 hours of operating time. According to Robert Williams, project's general superintendant, only normal nozzle service has been required and that under its regular monthly service schedule, no fuel injection pump trouble has arisen.

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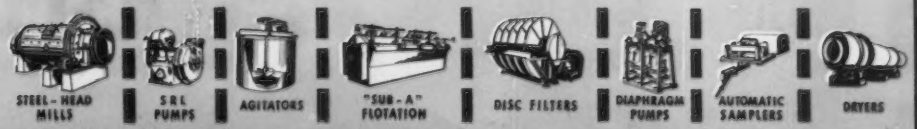

OPERATING IDEAS *(Continued)*

Torque Wrench Prevents Damage

TO INSURE PROPER TIGHTENING of bolts on hydraulic pumps and valves or on any piece of machinery where too little or too much pressure could cause major damage, Caterpillar Tractor Co., Peoria, Ill. recommends the use of the torque wrench.

There are many cases, the company states, where bolt pressure need not be brought to an exact amount. However, hydraulic pumps and valves "have small internal clearances—while it is desirable to have the parts of these units assembled tightly, too much tightening will reduce internal clearances to zero. Main and connecting rod bearings are round only when the correct torque is applied to the cap nuts. Too much torque will put these bearings out-of-round and cause failure of the parts when the engine is put into service. Excessive tightening of cylinder head studs can distort the head, with a good probability of leakage, warping and cracking."

Caterpillar goes on to say that if the torque wrench is used correctly, it will consistently give accurate results. Torque should be brought up in increments by using a steady pull. Jerking the wrench will result in higher torques than are actually indicated on the wrench dial.

New Bushing Adds to Mill Safety

A NEW TYPE BUSHING has made mills run smoother, has cut down on maintenance and repairs, and has removed a safety hazard at Kennecott Copper Corp.'s Chino Mines Div., Hurley, N.M.

The principle of the new roll mill design is that the inside of the hub is tapered to fit the tapered outside of the bushing. When pulled together with bolts through the flange of the bushing, the unit locks itself onto the shaft. There is no weight hanging on the bolts, so they do not break and become a safety hazard.

The taper lock bushing was first installed in 1956, and, according to Chino, is still in use and wearing well. A total of 11 have been made in the Hurley shop—each of the four mills requires two and the others are for standby.—From the company magazine, *Chinorama*.

Mining Units Do Surface Job

A LOADING MACHINE and shuttle car, normally used underground, recently transported surface material at the refinery of United States Potash Co., Carlsbad, N.M.

The machines carted the red granular from the company's warehouse No. 2 to warehouse No. 3 (the two are not joined by conveyors).

After being loaded in warehouse No. 2, the shuttle car carried the product to the regular granular dump pit where it was transferred via conveyor to warehouse No. 3.

Company representatives said that the two units took to the pile of granular as if they had been designed for the job.—From USP's company magazine, *Pioneer*.

Improved Cleaner Does Away With Continuous Filter Replacement

FILTER CLOTH LIFE can be extended, and, according to the Dow Chemical Co., costs can be greatly reduced by using Versene cloth cleaner.

One of the main reasons for changing a cloth is that polyvalent metallic salts precipitate and/or occlude on the interstices of the cloth itself.

Dow reports that in one of the large uranium mills, before they began the Versene treatment, it was necessary to change filter cloths every 10 to 15 days at an over-all cost of approximately $300 per filter bank.

"With Versene cleaning every 10 to 15 days, the life of the filter cloth has been extended five to eightfold and cost of the Versene treatment is $60 per filter bank, compared with the cost of $300 for complete filter change."

To calculate the capacity of the Versene solution to chelate metallic ions, Dow says, an analytical method can be used which will show the quantity of active or unreacted Versene in solution. The technique can be used to calculate the strength of the original Versene solution and can act as a check on its strength as it nears exhaustion. Check with Dow for details.

B.F.Goodrich

B.F.Goodrich tires give miner 25% more mileage than other makes!

WINTON Coal Mining Company works the strip mines in and around Tamaqua and Coaldale, Pa. Eighteen dump trucks haul tons of coal 15 miles over winding, mountainous roads. Low tire mileage and premature failures were problems for Winton until the company switched to B.F.Goodrich tires. Result: tire failures way down, mileage up as much as 25% over other makes—even two retreads.

Winton uses the Rock Logger tread which, like the new Rock Service, Universal and other B.F.Goodrich tires for mine work, is specially compounded to resist rock cuts and bruises. Rugged cleats bite in for full traction in forward or reverse. For extra-rugged jobs, you can get tires with B.F.Goodrich FLEX-RITE NYLON construction.

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WHAT'S NEW IN U. S. PATENTS

OLIVER S. NORTH

Mining

Method for forming long-wearing drill bits having inserts made of hard metal. Bit life is increased by providing its wearing face with a larger area of hard metal where the insert height is still great, but progressively more and more of the tougher metal as the insert height approaches the zone of danger of breakage on account of mechanical stresses. D. W. Haglund, assigned to Sandvikens Jernverks Aktiebolag. No. 2,842,342.

Metal and Mineral Processing

In the extraction of lithium carbonate from spodumene ore, the ore is sulphated, the sulphate leached out and reduced with either NH_4F (No. 2,840,-453) or H_2S (No. 2,840,455) and subsequently carbonated with CO_2 and NH_3. Li_2CO_3 is filtered out of the reaction solution. T. E. Dwyer, assigned to Tholand, Inc. No. 2,840,453 and 2,840,455.

Improved method of and apparatus for production of titanium or zirconium by reacting a volatile halide thereof with magnesium. D. S. Chisholm and D. F. Hall, assigned to Dow Chemical Co. No. 2,840,465.

Apparatus and process for producing titanium or zirconium metal, in either powder or ingot form, from chlorides of those metals. H. K. Najarian, assigned to St. Joseph Lead Co. No. 2,840,466.

In a process for separating columbium from tantalum, a mixture containing $TaCl_5$ and $CbOCl_3$ is treated with a solvent, for example, SO_2, to dissolve the $TaCl_5$. Resulting solution is separated from the undissolved fraction. W. Schornstein and F. Kern, assigned to Ciba Ltd. No. 2,842,424.

Method for agglomerating rutile in a shaft reactor without resorting to briquetting. Between 5 and 20% of Kennecott slag is added to the rutile-coke charge to effect soft bonding of the ore particles. Agglomerated product is lower in cost than briquettes and can be chlorinated at a reasonably high rate without attaining undesirable fluidization. J. N. Andersen, assigned to Stauffer Chemical Co. No. 2,842,425.

One-stage process for separation of nickel and cobalt from solutions containing mixtures of their salts. Chlorine and an alkali metal carbonate or alkaline earth metal carbonate are added in such proportions as to gradually increase the pH of the solution from about 2 to about 4. Most of the cobalt present is precipitated as a hydroxide, which is then rapidly separated from the solution to prevent absorption of nickel. F. Reynaud and G. Terraz, assigned to Societe d'Electro-Chimie d'Electro-Metallurgie et des Acieries Electriques d'Ugine. No. 2,842,427.

Method for using alumina by-product "red mud" in the preparation of low-grade iron-bearing materials, such as ores, ore fines, and flue dust, for smelting. Mud is dried to lump form and admixed with the ore, and the mixture sintered to form lumps suitable for charging into the blast furnace. O. Kippe, assigned to Paul O. Tobeler, doing business as Trans-Oceanic. No. 2,842,-434.

Hydrometallurgical method for recovery of nonferrous metals from mixtures thereof with iron and/or aluminum. J. O. Dasher and A. J. Beyer, assigned to U.S. Atomic Energy Commission. No. 2,842,436.

Treatment of Mayari-type iron ores with HCl gas and/or chlorine to produce $FeCl_3$, which is treated with water vapor to convert the iron to oxide form. J. E. Eberhardt, assigned to Bethlehem Steel Co. No. 2,843,472.

Production of aluminum from an aluminous material, such as bauxite or clay. Material is heated to a high enough temperature to vaporize aluminum subsulphide, which is withdrawn and cooled to produce metallic aluminum plus aluminum trisulphide. P. Weiss, assigned to Vereinigte Aluminium-Werke, A.-G. No. 2,843,475.

COPIES of U.S. patents can be purchased at 25¢ each from Commissioner of Patents, Washington 25, D. C.

As an improvement in the alkali cyanide leaching treatment of gold, silver, or platinum ores, a direct electric current at 6 to 8 volts is passed through the leaching bath in which the solids to liquid ratio is between 1.5 : 1 and 4 : 1. Percentage recovery of the precious metal is substantially improved. O. W. Haugen. No. 2,843,538.

In the separation of molybdenum from tungsten, scheelite concentrates are heated under pressure with NaOH. After the digestion, the mixture is diluted and filtered, and the solution treated with HCl to reduce the pH to 9. Dimethylin dichloride is added, and a tungsten precipitate recovered. R. C. Osthoff, assigned to General Electric Co. No. 2,843,613.

Method of forming a lump iron smelter product from finely divided iron ores, blast furnace flue dust, etc. Ore is wet-mixed with dolomitic hydrated lime or the like, the mixture pelletized or otherwise formed into lumps or pieces, and the pieces then reacted with CO_2. This lump ore has the thermal and chemical characteristics of natural lump ore. C. R. Amberg, assigned to Blocked Iron Corp. No. 2,844,457.

In the reduction of zinc ores or compounds to metallic form, the zinciferous material and a reducing agent are introduced into a fused bath composed of an alkali metal chloride salt or an alkali metal halide. Zinc is recovered as a vapor. J. L. Wyatt, assigned to Horizons, Inc. No. 2,844,461-2.

Pre-treatment of monazite sand with sodium hydroxide. Water-insoluble compounds of thorium, uranium, and rare earths are formed and separated, and the NaOH solution recycled with a new supply of monazite sand. Flow diagram shows essential steps in this process. G. D. Calkins, assigned to U. S. Atomic Energy Commission. No. 2,811,411.

Process for recovering uranium compounds which have been absorbed in an anion exchange resin. Resin is contacted with a carbonate eluant to desorb uranium, and the eluate then heated to decompose the carbonate, lower pH value, and precipitate uranium values. R. H. Poirier, assigned to U. S. Atomic Energy Commission. No. 2,811,412.

Pelletization of metallic ores, by-products, metallurgical wastes, and the like for metallurgical uses. Pulverized raw material is mixed with a heavy hydrocarbon pitch, a hydraulic binder, and a hydrocarbon oil and cold pressed into pellets. Process is especially suitable for treating pyrite screening residues, blast furnace dusts, and residual bauxite muds. A. R. Subervie, assigned to Metal Suberdop S. A. No. 2,808,325.

Removal of ferrous sulphate contamination form nickel-colbalt sulphate solutions. Air containing SO_2 gas is blown through the solution to oxidize ferrous ions, and ferric iron then precipitated with a basic agent and removed, leaving a purified nickel-cobalt solution. A. E. Wallis and D. H. West, assigned to International Nickel Co., Inc. No. 2,816,-819.

Matte smelting of copper sulphide ores. Silicon carbide is added in the blast or reverberatory furnace to decrease amount of magnetite in the slag by reacting with it to form FeO, which in turn forms a silicate slag with silica. J. B. Cunningham and C. E. Wooddell, latter by A. K. Wooddell, executrix. No. 2,816,019.

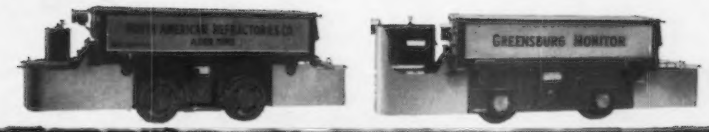
Blast-furnace smelting of lead-zinc ores, concentrates and the like. Patent contains a lengthy discussion of methods used and problems encountered in smelting these mixed ores. S. W. K. Morgan and G. K. Williams, assigned to Metallurgical Development Co. No. 2,816,022.

Improved process for roasting sulphide ores of copper, nickel, cobalt, zinc, etc. Ore is subjected to a preliminary roast in the 600 deg-800 deg C range without addition of SO_2 until a portion of the sulphur equivalent to the amount combined with iron volatizes. L. Schlecht and R. Staeger, assigned to Badische Anilin- & Soda-Fabrik Aktiengesellschaft. No. 2,817,583.

Mr. North is patent consultant, Washington, D.C.

National Mine Service Company

GREENSBURG MINE LOCOMOTIVES



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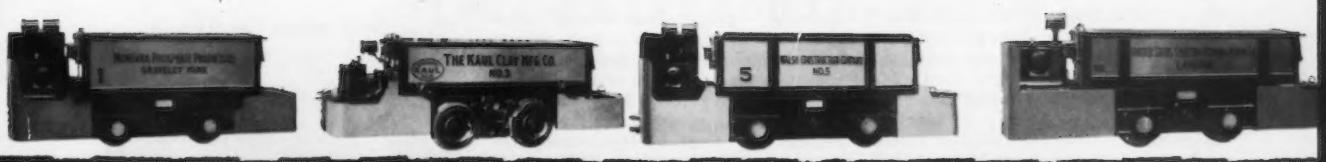

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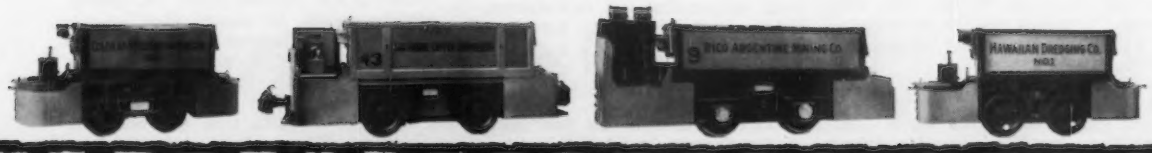

National Mine Service Company

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CLARKSON DIVISION, Nashville, Ill.
GREENSBURG DIVISION, Greensburg, Pa.
KY.-VA. DIVISION, Jenkins, Ky.
ALL-STATE DIVISION, Logan, W. Va.
MOUNTAINEER DIVISION, Morgantown, W. Va.
WESTERN KY. DIVISION, Madisonville, Ky.
WHITEMAN DIVISION, Indiana, Pa.

PERSONALS

George P. Lutjen, district manager for McGraw-Hill Publishing Co. in the New England district since 1957, and former managing editor of *Engineering & Mining Journal,* has accepted the post of assistant to the publisher of *American Metal Markets,* effective August 1.

Lutjen

A graduate of Columbia College, Mr. Lutjen received a B.A. degree in 1941, and a B.S. degree from Columbia's School of Mines in 1942. After graduation he joined Freeport Sulphur Co. as a mining engineer and remained in the Louisiana area until 1949, except for three years with the U. S. Marine Corps, in the South Pacific and China.

Mr Lutjen joined the staff of *E&MJ* in January 1949 as an assistant editor, becoming associate editor in 1950. He joined the U. S. Atomic Energy Commission in 1951 as a mining engineer with staff responsibility for exploration activities on the Colorado Plateau, and returned to *E&MJ* in March 1952. In the course of his career with the editorial staff of the magazine, Mr. Lutjen has traveled extensively throughout the mining areas of the United States, eastern Canada and the Caribbean.

With Alvin W. Knoerr, Mr. Lutjen received the Jesse H. Neal award for outstanding journalism in 1954 and 1956 and the Industrial Marketing award for technical journalism in the same years. He is co-author, with Mr. Knoerr, of the book "Prospecting for Atomic Minerals."

Robert W. Peckham, a graduate of Denison University, replaces Mr. Lutjen. Mr. Peckham first joined McGraw-Hill as a member of the headquarters sales training program and for the past year has been on the staff of *Coal Age-E&MJ* market research department, handling both research and sales promotion assignments, and also has had sales experience on *E&MJ Metal and Mineral Markets.*

Earl O. Torgerson, metallurgist, has been made project manager for Utah Construction Co. of the San Dong tungsten complex of Korea Tungsten Co., Korea. He succeeds **Arthur Kendall.** A graduate of Colorado School of Mines, Torgerson was formerly assistant superintendent of Salt Lake Tungsten Co.'s refinery.

W. A. Eldon, engineer for the lithium processing plant of Foote Mineral Co. at Kings Mountain, N. C., has been promoted to project engineer in the company's central engineering department at Philadelphia.

Clare E. White, formerly general manager of United Keno Hill Mines, Ltd., Yukon Terr., has been elected president and chief operating officer of Ungava Iron Ores Co., Montreal.

Homer S. Anderson, resident engineer, was appointed manager, mining department, of the New York and Honduras Rosario Mining Co., New York.

Edwin O. Woster, production superintendent of Anaconda Aluminum Co., became general superintendent, succeeding James F. Smith, present plant manager. Smith succeeded H. G. Satterthwaite, retired. **Charles E. Taylor** assumed Woster's duties while **Lars A. Ryssdal,** potline engineer, became potline superintendent. **James H. Foreman** became potline engineer.

J. N. Anderson has been appointed director of smelting operations for Noranda Mines, Ltd. and its subsidiary, Gaspe Copper Mines Ltd. **G. C. McKerrow,** who has been in charge of Gaspe Copper Mines' smelting operations, succeeds Anderson as smelter superintendent at Noranda. **R. L. Johnston** replaces McKerrow.

Satterthwaite

Smith

James F. Smith, general superintendent in charge of Anaconda Co.'s Columbia Falls, Mont. operations, has been made manager of the aluminum reduction works, and replaces **Howard G. Satterthwaite,** who retired July 1. Smith, with Anaconda since 1927, served in Great Falls for 25 yr before his transfer to the aluminum plant. Satterthwaite joined Anaconda in 1916, rose to assistant general superintendent of the Great Falls reduction plant, became manager of the new aluminum plant in 1952, and during World War II managed the Basic Magnesium Inc. plant in Henderson, Nev.

D. M. Giachino, mining and metallurgy graduate of Queen's University active in the mining industry for 25 years, has been appointed operations liaison engineer of Little Long Lac Gold Mines Ltd.

L. R. Garland, formerly mill superintendent for Cowichan Copper Co., Ltd., and Yale Lead & Zinc Co., Ltd., has been appointed mill manager for Mexuscan Development Co., Ltd., at Minas Quintera, Alamos, Mex.

Maurice W. Tate has been appointed chief of metallurgical investigation for Compania Aguilar S. A., Estacion Tres Cruces F.C.N.G.B., Prov. de Jujuy, Argentina. He is a member of the Canadian Institute of Mining.

P. H. Anderson is the new president of the Transvaal and O.F.S. Chamber of Mines; **W. J. Buschau** and **H. C. Koch** have been elected vice presidents.

D. J. Reed has been named electrical design engineer at Kennecott Copper Corp.'s western mining division's engineering staff and **Hans H. Pick** was named process design engineer. Pick worked for mining firms in Bolivia and Argentina prior to joining KCC and Reed joined Kennecott in 1956.

H. A. Oaks, mining engineer and formerly with Mining Evaluation Co. in Noranda, is now with T. A. Richardson & Co. as a partner and mining analyst.

Leonard P. Chalmers has been named to the board of Can-Met Explorations Ltd.

O. W. Waters, Virgil D. Cooper, and **E. Eugene Meyers,** employees of St. Joseph Lead Co., have retired as of August 1.

Sidney C. Howell, chief mining and industrial engineer for Republic Steel Corp.'s Northern Ore Mining district at Duluth, has been appointed district manager of the Lake Superior area mines. He succeeds **F. H. Cash,** who retired.

Walter A. Sterling, president of Cleveland-Cliffs Iron, was elected chairman of the board, succeeding **Alexander C. Brown,** who has retired after nearly 24 years of service. Both will continue as directors.

Arthur O. Wellman, Kenton R. Cravens and **Nicholas P. Veeder** were named directors of American Zinc, Lead & Smelting Co., St. Louis. **Dan R. Stewart,** Joplin, Mo., was promoted to district manager of the firm's development activities in Missouri, Kansas and Oklahoma; he was previously western geologist and acting district manager.

"Panning Contest" in Alaska

Looking over Alaska this summer were **Merle H. Guise** and Mrs. Guise. Guise recalls when it was a live "boom" gold camp in his boyhood days. While attending the "Golden Days" celebration in Fairbanks, he entered the "International Gold-Panning Contest," and "risked his title of 'world champ'." He lost out by six seconds, to an old sourdough pal, **Chris Ableguard** (second from right), whose time was one minute and 30 seconds. Guise (left) says "loss of title did not hurt as much as the loss of first prize, an ounce of "dust."

Roasting Supt. Charles Noonan, The Bunker Hill Co. Electrolytic Zinc Plant, Kellogg, Idaho. ESCO Spacer Casting exhibited by Noonan has been removed for inspection after 18 months of continuous service and is still in perfect operating condition.

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PERSONALS

Johnson

Pardee

Hugo E. Johnson was elected president of the American Iron Ore Association, Cleveland, effective September 1. **Franklin G. Pardee,** whom Johnson succeeds, has retired. Johnson has been with the association since 1954, prior to which he was assistant manager of the project development group at Battelle Memorial Institute, Columbus, Ohio. Previously, he had been with United States Steel Corp. as research associate. He holds a metallurgical engineering degree from Ohio State University, and is a member of AIME, American Iron & Steel Institute, Association of Iron and Steel Engineers, the ASM, and the American Association for the Advancement of Science. Mr. Pardee has been president of AIOA since 1952. After taking a degree from University of Wisconsin in mining engineering, he worked in Cripple Creek, Colo., joining the U. S. Army Engineers in 1917. Since then he has been with M. A. Hanna Co. in northern Minnesota and Michigan and has done consulting work in iron ore and other minerals developments in both North and South America. He plans to open an office in Crystal Falls, Mich. as consulting mining engineer and geologist.

Walter E. Heinrichs Jr., general manager for the past three years of Minerals Exploration Co., has now formed Heinrichs Geoexploration Co. at Tucson, Ariz., a mineral engineering consulting and contracting firm.

James W. Byrkit has retired as smelter superintendent of Phelps Dodge Corp.'s New Cornelia branch. **Frank W. Denney,** general smelter foreman, succeeds Byrkit. **Forrest R. Rickard** succeeds Denney.

Joseph I. Horty, editor of Hercules Powder Co.'s magazine, *The Explosives Engineer,* and manager of explosives advertising, has retired after 42 years of service. At a luncheon to honor *The Explosives Engineer,* which for the seventh time in 10 years has won the National Safety Council's Public Service Award, the presentation was made on behalf of the NSC by J. James Ashton, of the Delaware Safety Council, to Albert E. Forster, president and chairman of Hercules, who in turn presented it to Mr. Horty. He was also given a letter of commendation to *The Explosives Engineer* from Ned H. Dearborn, president of the NSC, in which credit for NSC's inauguration 33 yr ago by the U. S. Bureau of Mines was given to the editors of the Hercules paper.

W. W. Beebe, superintendent at the Monroe mine of Oliver Iron Mining division, has been made superintendent of the Sherman group crushing and screening plant. Walter J. McGuire succeeds him at the Monroe.

Edwin C. Sponberg, superintendent of the Scranton mine, Hibbing, for Pickands, Mather & Co., has retired after over 32 years' service.

John S. Hassett, of Cleveland, an assistant to Charles S. Arms, has been appointed assistant manager of mining plans and controls for Pickands, Mather & Co. **William E. Snavely** has also been made assistant manager of mining plans and control under Mr. Arms. **Bruce E. Kennedy,** mining engineer in PM's Duluth office, is now in charge of exploration and geological work in Canada with headquarters in Montreal. **Richard H. Hanson,** assistant supervisor of industrial relations, Duluth, has been transferred to the industrial and public relations department, Cleveland.

Bakarian

Moklebust

P. William Bakarian has been appointed president and general manager of R-N Corporation. He was president of Cramet, Inc., Chattanooga, Tenn., and had been with Dow Chemical Co. in metal development work, from 1937 to 1942. Bakarian holds degrees in electrochemistry from Massachusetts Institute of Technology and a doctorate in physics of metals from Yale University. During World War II, he had special assignments on the WPB and in U. S.-British technical coordination. In 1946 he joined Almag Engineering Co. in England as chairman and managing director; in 1952 he served as chief, industry and transport staff, U.S.A. Point Four Program for Middle East, Department of State.

John S. Breitenstein and **Rollin P. Smith** have been named vice presidents of R-N Corp. Breitenstein, who has been assistant to the president, will be in charge of administration. Smith will be in charge of engineering.

Olav Moklebust, formerly director of the Titania A/S pilot plant at Sokndal, Norway, a National Lead subsidiary, has been appointed superintendent of R-N Corp.'s pilot plant in Birmingham, Ala.

Phillip F. Allen, formerly metallurgist at the Morenci branch, is now superintendent of the Lavender Pit concentrator, Copper Queen branch, Phelps Dodge Corp., Bisbee, Ariz.

D. W. Carlton, formerly district engineer for Pickands Mather on the Cuyuna range, is now assistant chief engineer of Erie Mining Co., Hoyt Lakes, Minn.

W. J. Tuohy has been named to the board of directors of Cleveland-Cliffs Iron Co. and **H. S. Harrison,** a director, was elected executive vice president.

Rudolph Ekar, Chisholm, Minn., was appointed chief mining engineer of Snyder Mining Co., as of June 1, following A. C. Borgeson's retirement. **Mauri E. Erkkila** was appointed assistant chief mining engineer, replacing Ekar. Also, **Theodore J. Barker** succeeds **R. M. Baker** who retired May 31, as superintendent of Snyder Mining Co.'s Whiteside mine. Barker had previously been assistant superintendent.

J. J. Danjoy, J. Pinsard and **L. Montague,** of France, are touring the mining districts in the U. S. to observe large scale mining operations and machinery and equipment in active use in open pit mines. Recently they visited Hibbing, Minn. and Mesabi range mines.

Carl H. Cotterill was named executive assistant in American Zinc, Lead & Smelting Co.'s executive department, effective July 1. After taking his degree in chemical engineering from Missouri School of Mines in 1940, he joined the company as metallurgist in the Dumas, Tex. plant, and has been plant and process investigator in their St. Louis office since 1948.

Warren H. Leverett retired as president of National Zinc Co. July 1. He will remain a director of the company. Prior to joining NZ in 1916 as assistant superintendent of the Kansas City, Kan. plant, he had been with Edgar Zinc Co., now part of American Zinc Co. of Ill. Succeeding him as president is **Frederick R. Jeffrey,** vice president of NZ and vice president of the parent corporation, International Minerals & Metals Corp. **Bern F. Buff,** general superintendent of the Bartlesville plant was named general manager.

Coope

Davis

G. F. Coope retired as president of Potash Company of America, as of August 1. He will remain on the board of directors and the executive committee of the company and will also be a consultant. Mr. Coope has been with the company for almost 22 years. **F. O. Davis,** executive vice president and treasurer, succeeds Coope as the new president.

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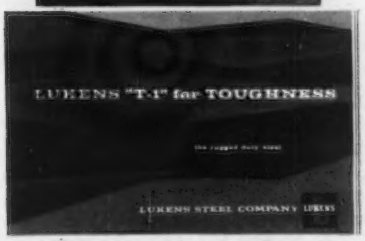

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PERSONALS *(Continued)*

Raymond E. Byler, outstanding authority in the metallurgical and chemical field, has been appointed manager of Research and Development by Western Machinery Co. Formerly with Arthur D. Little, Inc. and the Merrill Co., San Francisco, Byler also served during World War II as chief engineer in charge of process development and plant construction for production of pyrophoric metal power for the Chemical Warfare Service. A graduate of University of California's College of Mining and Metallurgy, he has been engaged in the design and operation of plants and in research and development of metallurgical and chemical process for beneficiation of ores in Mexico, the western U.S. and in Canada since 1924. He has authored a number of articles and is also co-holder of several patents in the processing field.

Byler

Rudolph C. Gebhardt, geologist and mining engineer, has been named manager of E. J. Longyear Co.'s mining division, succeeding **Dr. Donald M. Davidson,** who became president of the company July 1. Gebhardt, formerly senior geologist and mining engineer at Longyear's consulting office in Denver, Colo., will head the Minneapolis division and will be in charge of geological and mining consultation.

Gebhardt

Dr. John H. Dismant, formerly principal research engineer with International Minerals & Chemical Corp., Mulberry, Fla., is now associate professor of mining and metallurgy at Texas Western College, El Paso, Tex.

Dr. Nathan M. Levine, mining engineer and most recently with Howe Sound Co., has joined the technical division's development department of Stein Hall & Co. A graduate of C.C.N.Y. with a B.S. in mineral dressing engineering and an M.S. and Ph.D. from the School of Mines, Columbia University, Dr. Levine has also worked for U.S. Smelting, Refining & Mining Co., New Mexico, and in the field of taconites at Wisconsin Alumni Research Foundation, and has done work on recovery of uranium from shales for the Columbia Minerals Beneficiation Laboratory.

Levine

Ernest E. Thurlow, exploration geologist for the A.E.C. Division of Raw Materials for the past 10 years, has accepted the post of chief geologist for Marcona Mining Co., Peru, a joint venture of Utah Construction Co. and Cyprus Mines. His work with the AEC included charge of exploration offices in Spokane, Salt Lake City and Denver, starting in the Washington, D. C.-New York City offices of the division of raw materials in 1947. He was responsible for the exploration program in sections eventually covering all of the western U. S. except the Colorado Plateau.

Thurlow

S. Power Warren resigned from Ball Associates as of July 1 to return to his private consulting practice in Denver.

Dr. Henry Seawell Brown, formerly head of the geology and geography department at Berea College, Ky., has been named assistant professor of geological engineering at North Carolina State College.

OBITUARIES

R. C. Gegg, 54, known in mining-metallurgical circles through his many years of association as an operator, died recently at his home in Lakefield, Ont. Mr. Gegg, a McGill University graduate, played a leading role in Little Long Lac gold camp's development, was mill superintendent there, and assistant manager at MacLeod-Cockshutt Gold Mines. He was with Ventures Ltd. prior to his association with the research programs of Quebec Metallurgical Industries.

Francis W. Gray, former editor of *Canadian Mining Journal,* died June 10 in Victoria, B. C.

Ernest Klepetko, 69, well-known metallurgist, died June 27, at Polson, Mont. A Columbia University graduate, Klepetko had been associated with Anaconda Co. early in his carer, and later with Combined Metals Co. at Bauer, Utah, where he developed a process for recovery of resin from Utah coal.

Clyde M. Lyon, former Idaho Springs mining man who built the Silver Spruce mill outside east Idaho Springs, died at St. Anthony's Hospital, Denver, Colo.

Clifford McIntosh, 62, manager of mines and chief engineer for Great Northern Iron Ore Properties, Marble, Minn., died June 27, at Hibbing.

F. A. Flodin, 55, of Iron Mountain, Mich., and president of Lake Shore, Inc., died June 20.

Trevor John Vaughan-Rhys, 88, manager and vice president of Faith Mining Co., Hughesville, Mont., died July 26 en route to a Great Falls hospital.

Kenneth Cooke Brownell, 55, chairman of the board of American Smelting and Refining Co., died August 4 at Columbia-Presbyterian Medical Center. Mr. Brownell joined Asarco in 1927, after graduating from Yale University in 1925 and after attending the Graduate School of Business Administration at Harvard University. He rose within the company through the ore purchasing and sales departments to become vice president in 1936, executive vice president in 1947 and president in 1949. He was elected board chairman last year. Mr. Brownell was a director of Revere Copper & Brass Inc., the Great Northern Paper Co., General Cable Corp., the Chase Manhattan Bank of New York and the First National Bank of Greenwich. His home was at Round Hill Road, Greenwich, Conn.

Brownell

Michael P. Cloonan, mining engineer and public relations executive for Ozark Mahoning Mining Industries, died July 15. Cloonan was president of Colorado Mining Association in 1956; a board member of Colorado Metal Mining Fund; commissioner of Jackson County for 20 years and past president of Colorado County Commissioners Association.

Samuel Barker, 89, Butte mining man and civic leader, died July 20. He was resident engineer for Butte Copper & Zinc Mining Co., and had been associated with Grey Eagle Mining Co. for several years. Earlier, he had been a partner in the engineering firm of Wilson and Gillie. He was a member of AIME and Montana Society of Engineers.

William B. Poindexter, a vice president of M. A. Hanna Co. and for the last 12 years vice president in charge of the lake coal division, died May 26 in Cleveland, Ohio.

Allen B. Williams, retired Aluminum Co. of America executive, died May 16 in Pittsburgh. Williams became vice president of Aluminum Ore Co. in 1942, and president in 1946, retiring in 1955 as general manager of Alcoa's refining division. Aluminum Ore Co. had been made an operating division of Alcoa.

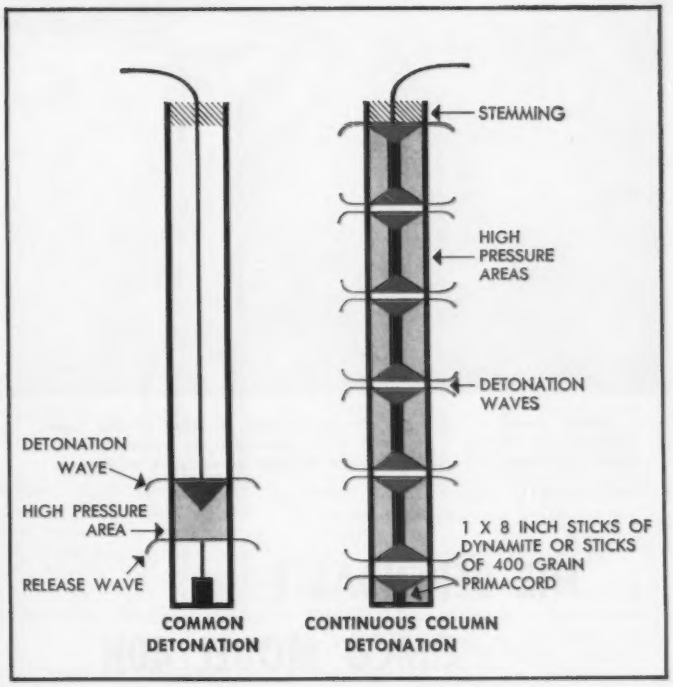
Edward C. Bradley, 75, whose company, E. C. Bradley & Sons, operated the Bradley open pit mine at Iron Mountain, Mich. for Jackson Iron & Steel Co., died June 13.

H. V. Kruse, 69, retired chief mechanical engineer for Phelps Dodge Corp.'s western division, died June 10, at Minneapolis, Minn. A major engineering achievement was his supervision of the design of the Lavender Pit concentrator. Kruse's home was at Douglas, Ariz.

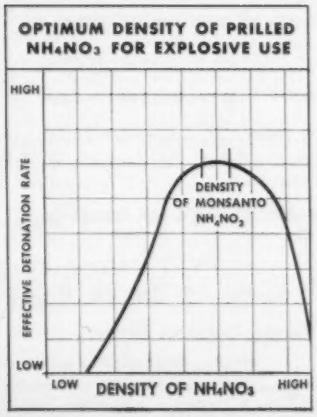
Explosives News from Monsanto Research

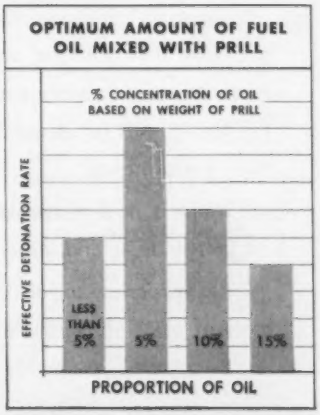
PRILLED AMMONIUM NITRATE IN CONTINUOUS COLUMN DETONATION GIVES BETTER BREAKAGE, SAVES DRILLING AND CRUSHING COSTS!

Continuous column detonation (right) gives better shatter because entire hole detonates approximately at speed of Primacord* (20,000 to 21,000 ft/sec.). Notice no release wave structure . . . entire hole works. Faster detonation cuts heat loss. Contained heat results in gas expansion—produces more work for less money. For the most favorable results, make sure hole is filled with NH_4NO_3 but don't risk destroying the best prill-pack by tamping. Pour oil in bag of Ammonium Nitrate. Let set for at least ½ hour before loading, or use mechanical mixer. Monsanto Ammonium Nitrate gives you optimum density of prilled NH_4NO_3 for explosive use *and* optimum prill size.



Ideal rock breakage, like this, reduces crushing costs. The Monsanto method of detonation, in conjunction with a new, top-quality prilled NH_4NO_3 that Monsanto research developed, will yield the equivalent of 60 % gelatin dynamite at ¼ the cost.





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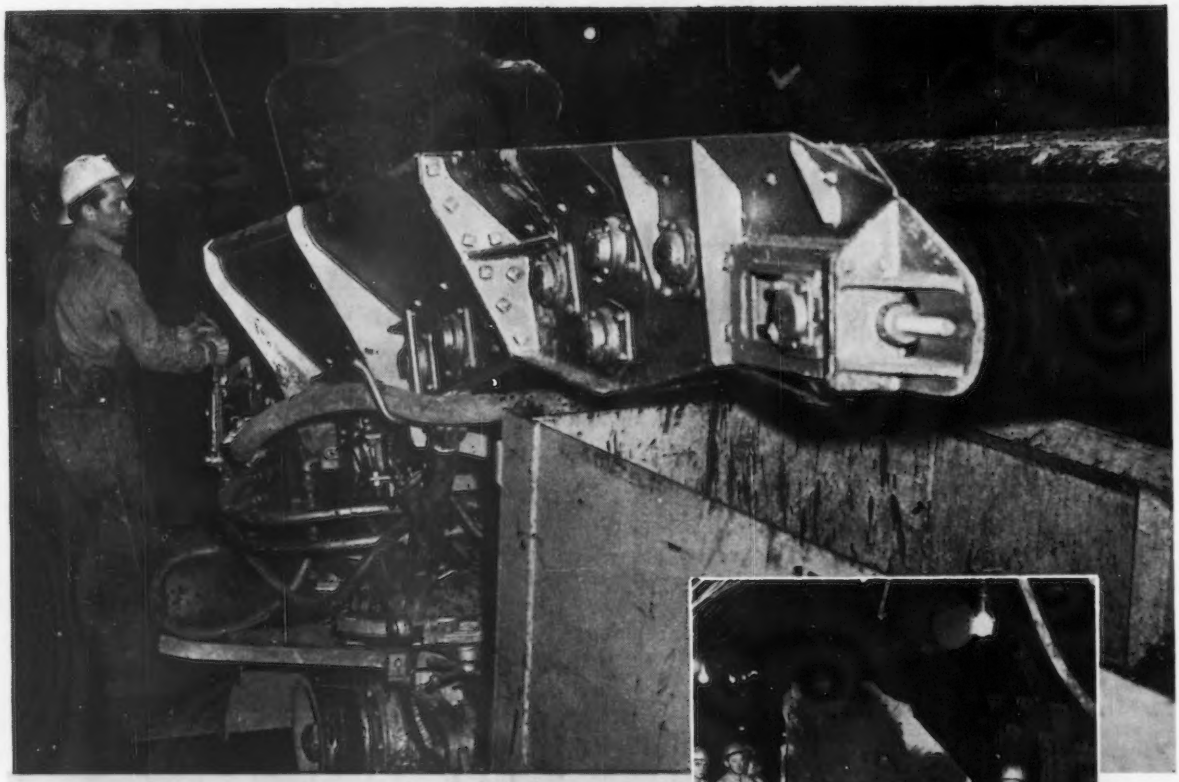

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Successful contractors, the world over, who make a profit on their job and achieve records in tunnel speed, have learned through experience that you cannot beat the Model 40H for dependable, month in and month out, high performance.

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NEW BOOKS

Progress in Mineral Dressing, prepared by the International Mineral Dressing Congress based on all the papers and contributions to the discussion presented at the 1957 meeting held at Stockholm (see *E&MJ*, November 1957). Published by the Congress, Nachstromsgatan 1III, Stockholm C, Sweden. Price $15.

Swedish Mineral Dressing Mills, prepared by the Swedish delegation to the International Mineral Dressing Congress, 1957. Contains flowsheets and process equipment data on most of the mills in Sweden. Published by the Congress. Address above. Price $6.25.

Concise International Dictionary of Mechanics and Geology, prepared by S. A. Cooper. English vocabulary is repeated in French, German and Spanish, then each word is indexed by language. Slightly larger than a pocket book. Published by Philosophical Library Inc., 15 East 40 St., New York, N. Y. 400 pp. Price $6.

Successful Process Plant Practices, by Robert L. Davidson, senior editor, *Petroleum Week*. Contains some 300 operating ideas for process control, operation, maintenance and safety, but with somewhat limited appeal to the mining industry since it is based on petroleum processing. Published by McGraw-Hill Book Co, Inc., 330 West 42 St., New York 36, N. Y. Illustrated in 302 pages. Price $10.

Properties of Gases and Liquids, by Robert C. Reid and Thomas K. Sherwood. Estimation and correlation of the more important physical properties of pure materials and mixtures—critical pressure, volume and temperature; vapor pressure; latent heat; etc. Published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N. Y. 386pp. Price $10.

Science of High Explosives, ACS Monograph No. 139, by Melvin A. Cook. Detonating processes and theory with plenty of illustrations and fundamental principles. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 440pp. Price $22.50.

Alphabetic Index For the Mining Dictionary, by Alexander Novitzky is a complement to his earlier *Mining-Metallurgical - Geological - Mineralogical-Petrographical and Petroleum Dictionary* which was published in five languages—English, Spanish, French, German and Russian. The Index is in four parts—Spanish, French, German and Russian. In each language, the words are arranged alphabetically. Each word is followed by the page number from the dictionary and the English equivalent word order on that page. Published by Alejandro Novitzky, Professor de Mineralogia y Petrografia de la Universidad Mayor de San Andres, La Paz, Bolivia, who may be reached at Emilio Castro 549, Temperley, Buenos Aires, Argentina. Price unlisted.

Reports and Bulletins

Industrial Minerals of Newfoundland, by G. F. Carr. Mines Branch publication No. 855. Maps, photos, mine diagrams and text. Published by Dept. of Mines & Technical Surveys, Ottawa, Ontario, Can. 158pp. Price $2.

Geology of the Waitaki Subdivision, by Maxwell Gage. New Zealand Geological Survey Bulletin No. 55. Maps, photos, tables and text. Published by Dept. of Scientific & Industrial Research, Wellington, New Zealand. 135pp. Price 40s (paper cover); 45s (quarter cloth).

Geology of Reefton Subdivision, by R. P. Suggate. Geological Survey Bulletin No. 56 and maps. Photos and text in 146pp. Maps in separate volume. Published by Dept. of Scientific & Industrial Research, Wellington, New Zealand. Price 60s.

Salt in California, by William E. Ver Planck. Division of Mines publication No. 175. Geology, history and production. Maps, text and illustrations. Published by Dept. of Natural Resources, State of California, Ferry Bldg., San Francisco 11, Calif. 168pp. Price $3.25 (cloth).

Bulletin No. 25—Ontario Dept. of Mines List of Publications. Revised to April 1958. Map and 69 pages. Published by Ontario Dept. of Mines, Toronto, Canada.

Selected Annotated Bibliography of Asbestos Resources in the U.S. and Canada, by Ruth Butler Avery, Mary Lou Conant and Helen F. Weissenborn. Geological Survey Bulletin 1019-L. For sale at the Superintendent of Documents. U.S. Government Printing Office, Washington 25, D. C. 48pp. Price 25c.

Geology and Magnetite Deposits of Dover District, Morris County, New Jersey, by Paul H. Sims (with a description of the geologic section at Hibernia mine by A. F. Buddington). Text, photos and maps. Published by Geological Survey as Professional Paper No. 287. Can be obtained from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 162pp. Price unlisted.

Mineral Localities in North Carolina, by James F. Conlay. Text and map. Prepared by the Division of Mineral Resources, Dept. of Conservation & Development, Raleigh, N. C. 83pp. Price 50c.

Uranium Procurement—the legal aspects of the AEC domestic ore purchase program, by Michael Scott and Edward M. Heppenstall. Reprint from *Michigan Law Review, Vol. 56*. May be obtained from Uranium Institute of America, 127 North 4th St., Commerce Bldg., Grand Junction, Colo. 16pp.

Leaching of Manganese From Pyrolusite Ore by Pyrite, by G. Thomas and B. J. P. Whalley. Mines Branch Research Report R 3. Text and graphs. Published by Dept. of Mines & Technical Surveys, Ottawa, Ontario, Canada. 7pp. Price 25c.

Virginia Manganese Minerals and Ores—a selected bibliography with excerpts by Arthur A. Pegau. Division of Mineral Resources Circular No. 7. Published by Dept. of Conservation & Development, Charlottesville, Va. 24pp.

Copper and Uranium Deposits of the Coyote District, Mora County, N.M., by C. M. Tschanz, D. C. Laub and G. W. Fuller. Geological Survey Bulletin No. 1030-L. May be obtained from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. 55pp. Price unlisted.

Yukon Territory—selected field reports of the Geological Survey of Canada, 1893 to 1933. Selected and compiled by H. S. Bostock as Geological Survey of Canada Memoir No. 284. Published by Dept. of Mines & Technical Surveys, Ottawa, Ontario, Can. 650pp. Price $3.

Jurassic Fernie Group in the Canadian Rocky Mountains and Foothills, by Hans Frebold as Geological Survey of Canada Memoir No. 287. Published by Dept. of Mines & Technical Surveys, Ottawa, Ontario, Can. 197pp. Price $2.75.

A Guide to the Known Minerals of Turkey, revised by C. W. Ryan. Minerals, location and size of deposit where known. Published by International Cooperation Administration, U. S. of America Operations Mission to Turkey, Ankara, Turkey; or to the Mission's Washington, D. C. office. 199pp. Price unlisted.

Colorado School of Mines Research Foundation, Inc.—what it is, how it operates, and what it can do for you. This non-profit, privately endowed Research Foundation can help you solve your mineral processing problems. Write to the foundation at Golden, Colo., for a copy of the booklet. 23pp.

Geology of the Concord-Waterford Area, Vermont, by John H. Eric and John G. Dennis as Vermont Geological Survey Bulletin No. 11. Maps and text. Published by Vermont Development Commission, Montpelier, Vt. 66pp.

Iron Deposits of Nevada, Part B—Iron ore deposits of west-central Nevada, by Robert G. Reeves, Fred R. Shawe and Victor E. Kral. Maps and text. Published by Nevada Bureau of Mines, Reno, Nevada. 79pp.

Motion Pictures

The Big Z, a color motion picture compiled by the Ontario Dept. of Mines in cooperation with the Blind River uranium producers. From bushland to 12 producers. Available for loan on two months waiting list from Ontario House, London, England; Canadian National Film Board, 630 5th Ave., New York, N. Y.; and the Dept. of Mines, Toronto, Ontario.

One Down, More To Go On Mill Expansions

THERE'S A GOOD POSSIBILITY that all five major proposals for uranium milling capacity expansions in the Gas Hills of Wyoming will be okayed shortly by the Atomic Energy Commission. These contracts will extend to Dec. 31, 1966. Allan E. Jones, manager of Grand Junction operations is hopeful that these contracts will be completed by the time you read this. Here's how the situation stands at this moment—

Two companies want and will probably get new mills in the area: Federal Uranium Corp. (Radorock Resources, Inc.), a 500-tpd mill based on the Infilco continuous counter-current ion exchange method; and Union Carbide Nuclear, a 475-tpd unit with an upgrader.

Union Carbide recently acquired the uranium reserves of Globe Mining & Milling Co. The Globe sale, announced by Darby Hand and his partner Page Jenkins, was rumored to be in the $2-million neighborhood, and gives Union Carbide control of 150 claims and about 250 acres of fee leases in the Gas Hills.

Union Carbide's proposal ended reports that the firm had withdrawn from the Wyoming milling picture because of its management contract with Columbia Southern Chemical Corp. which is seeking a milling contract for San Antonio, Texas.

Last fall Globe and Union Carbide submitted a joint proposal to build a 1,000-tpd concentrator. Globe later withdrew, but Carbide stayed in the press. Globe's claims hold an estimated 1-million tons of 0.2% U_3O_8. Union Carbide, on its own, had sufficient ore as of the Nov. 1, 1957 deadline to guarantee ore for a 200 tpd mill.

Both Jenkins and Hand intend to stay in the exploration business through their offices in Casper, Wyo.

Expansions being sought include—Lucky Mc Uranium Corp. which has now about 750 tpd capacity, including 10% overrun. Lucky Mc wants 1,100 tpd so as to include the ore reserves of Phelps Dodge Corp. and Lisbon Uranium Corp. Expansion can be added without greatly disturbing the present plant.

Fremont Minerals Corp., with 500 tpd capacity granted at Riverton, would like to go for 700 or 750. No sooner was this known publicly when Vitro Corp. of American & Pittsburgh Coal Co., joint owners of Vitro Minerals Corp., announced that they had entered into an agreement with Susquehanna Corp., owners of Mines Development, Inc. and Fremont Minerals, Inc.

Mines Development operates a 400-tpd mill at Edgemont, S. D. and Freemont Minerals is building a concentrator and acid plant at Riverton, Wyo. Vitro has been busy in the Gas Hills for about four years and had stacked up some 911,000 tons of Wyoming reserves by the deadline, based on exploration and development of only 22% of Vitro's 40,000 acre holdings. Under the agreement, Susquehanna will get Vitro Minerals and all its stock.

In turn, Vitro Corp. of America and Pittsburgh Coal will get a large ownership in Susquehanna, based on the total mineral resources developed and mined

Darby Hand

from Vitro Minerals property for processing at Fremont Minerals mill. With her reserves beefed up by the Vitro addition, Fremont Minerals is considered a good bet to get what she wants. The acid plant will have to be expanded with the milling expansion. Fremont expects that the mill will be completed by the end of the year.

Western Nuclear Corp., whose contract calls for 400 tpd and whose mill is proven to be able to handle 800 tpd, will be permitted to go at it at the new rate.

While all these maneuvers were going on, the AEC and Texas-Zinc Minerals Corp. signed a contract which provides for treating, not 4,600 tons of custom ore per month as of old, but a new and expanded 13,000 tons per month at Mexican Hat, Utah. This is the first solid, concrete result of the AEC's plan to expand domestic milling capacity to assist those miners who have no ore outlet. Mexican Hat will draw its custom ore from the 1,869,000 tons of reserves credited to the White Canyon-Monument Valley area as of the November deadline.

Contract extends until Dec. 1, 1966 and is expected to stabilize employment in the mines of the area as well as at the concentrator. Immediately affected are Industrial Uranium Co. and Radium King Mines, two of the principal independents in the district. Other independents are expected to share in the expansion. The new contract also states that Texas Zinc must run the AEC stockpile at White Canyon through the mill.

On the Washington scene—no sooner had the ink dried on the House bill chopping nearly $6-million from the AEC's fiscal budget, (earmarked at $5-million for the raw materials program and $768,000 for bonus payments) then the Uranium Institute's president, Jess Larson, presented his industry's view to the Senate Appropriations Committee asking that the money be restored. He stated "If the Commission does not have at its disposal sufficient funds to pay for ore it has contracted to buy, untold hardships will result to organizations and individuals who have planned their production and assumed obligations based upon the contractual assurances given them in good faith by the Commission." Other uranium miners added their weight of evidence and on Aug. 12, the Senate Committee announced that the nearly $6-million would be restored. The industry breathed a sigh of relief, when the Senate's action was okayed by the joint Senate-House conference on Aug. 19. Final bill, including the restored $6-million, totalled $680-million for domestic and foreign concentrate purchases in this fiscal year.

Seattle Light Completes Metaline Area Survey

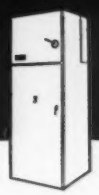
IN EARLY AUGUST, a study of the structural and underground water conditions in the Metaline Mining District was completed by City of Seattle Lighting Department, whose plan to build a hydroelectric dam at Boundary Site had been opposed by Metaline miners.

The miners charged that ore in the important lead-zinc district would become unminable and that some, "if not all," of the mining area below the reservoir level would have to be abandoned. A study by Wisser & Cox, San Francisco consulting geologists, with Leggette, Brashears & Graham, ground water hydrologists of New York, included study of mining records over a 20-year period, and drilling of 10 large rotary holes for pumping and six small holes for observation.

Wisser and Cox reports as follows: "Analysis of the extensive data thus gathered indicates to the City's consultants that the rocks of the Metaline Mining District are thoroughly saturated by ground water moving very slowly from the higher areas of the mountains to discharge at river level. In areas likely to be penetrated by mine workings in the future, the ore-bearing limestones are under high artesian pressures.

"It is the opinion of the City's consultants that if normal precautions are taken that a reservoir can be safely constructed. . . . with little or no risk to any future mining operations."

Newly designed
Type H Motor Control



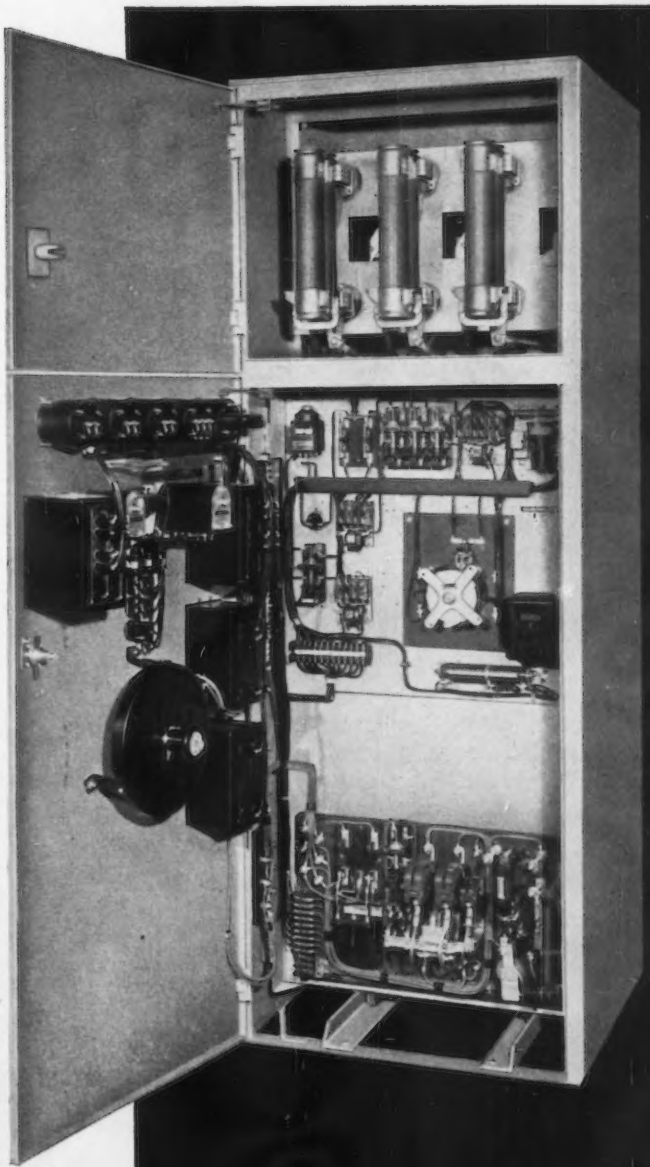
More room for optional features

Now, with Allis-Chalmers high voltage control, you get more panel space for additional components.

Meters, pushbuttons, instruments, rheostats, indicating lights, relays, and other components can be installed—thanks to the ample space available on both the outer door and inner barrier.

Along with more room, this new A-C design is front accessible, has smaller cabinet size, provides ultimate in protection for men and machines, and has been completely tested.

For more information on this engineering advance, contact your A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.



All this area on Allis-Chalmers new Type H motor control is available for optional features. In many applications, this extra space eliminates the need for an extra cabinet.

Removable panel, on which control devices are assembled, is mounted on inner barrier. Entire panel may be quickly removed for inspection and maintenance.

ALLIS-CHALMERS

A-5519

Rides with the bit through rock ...speeds big bore hole cuts...

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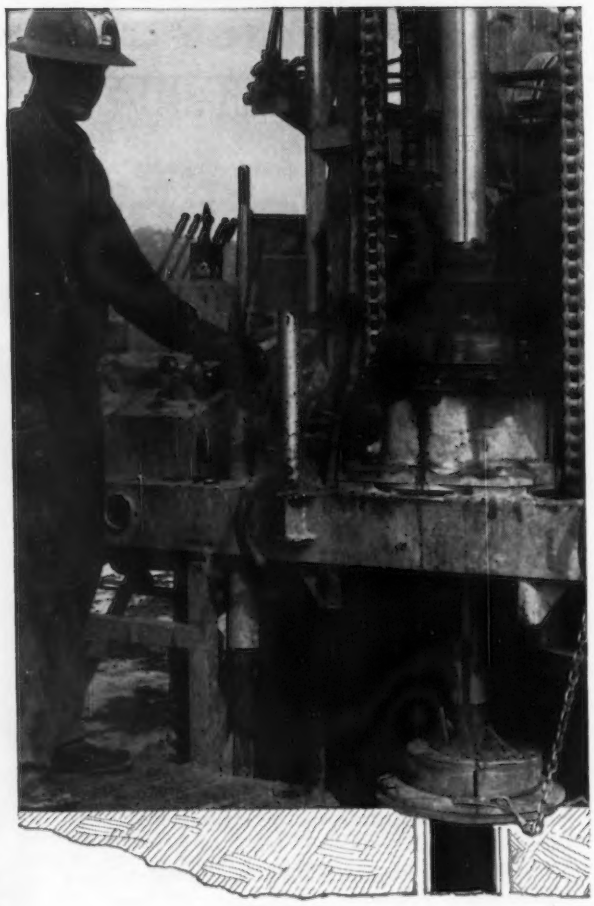
"MOLE-DRIL"*

* TRADE-MARK



Here's added power for your seismograph rig—hard-hitting, in-the-hole power. "Mole-Dril" speeds shot hole drilling . . . and deep hole drilling in hardest rock.

It's easy to use—the "Mole-Dril" screws directly onto the bottom of standard drill pipe . . . a tungsten-carbide "X" bit screws directly onto drill tappet. That's all the "make-ready" it takes to send the "Mole-Dril" through rock.

It's powerful—"Mole-Dril" delivers more foot-pounds of energy to the bit than any other drill of its size. Every pound of hammer energy is transferred directly to the bit.

It's rugged—the "Mole-Dril" has only three moving parts, nine major parts. This simple, rugged construction gives the "Mole-Dril" lasting deep hole drilling durability.

Two models available:

Model AM4 for drilling 4¾" diameter hole.
Model AM6 for drilling 6½" diameter hole.
Write for bulletin.

"Mole-Dril's" positive hole cleaning action

Air at full line pressure flows through drill's air blowing tube directly to bit . . . this direct air stream keeps cutting face clean regardless of drilling depth.

Drill exhaust air passes out up-cast air ports and gives cuttings an additional out-of-the-hole boost.

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Ray Smelter Ships First Copper Anodes

ANODE COPPER POURING started June 29 at Kennecott Copper Co.'s Ray Smelter at Hayden, Ariz., and the first two carloads of anodes were shipped July 3. The 700-lb anodes were shipped to Asarco's Baltimore, Md. refinery where they are electrolytically refined to approximately 99.95% purity. To July 23, 1500 tons of anodes had been shipped to the Asarco Refinery at Baltimore.

General manager A. P. Morris reported that the first copper shipments from the smelter did not mean that smelter construction had been completed. He said the two-year smelter construction project, which began in July 1956, would probably continue "in its final phases" until mid-October. He further said that Asarco's smelter would probably finish smelting Kennecott concentrates Aug. 31, 1958, at the termination of its smelting agreement with Kennecott." Asarco has been smelting Kennecott's Hayden production since 1911.

The Kennecott smelter was on a two converter 6-day basis and was scheduled to go to a two converter 5-day basis the week of July 28, according to Frank Woodruff, superintendent of the reduc tion plant.

Archibald Is Named 1959 Jackling Award Lecturer

RALPH S. ARCHIBALD, chairman and former president of North Range Mining Co., Negaunee, Mich., will be the recipient of the AIME's Daniel C. Jackling Award and will give the Jackling Lecture at the Institute's annual meeting in San Francisco in February 1959.

The honor, awarded annually, is for "significant contributions to technical progress in the fields of mining, geology and geophysics."

After receiving his degree of Engineer of Mines from Lehigh University in 1907, Mr. Archibald worked as geologist, mining engineer and mine operator until 1915 when he set up practice as a consultant. He was active in the development of mineral resources of the Great lakes region. In 1933, Mr. Archibald and his associates organized the North Range Mining Co., which operates underground iron ore mines, open pit iron mines, gold and lead-zinc mines, and which recently entered the uranium field. Mr. Archibald retired in 1957 as president of North Range.

Homestake Sapin Starts Concentrate Production

HOMESTAKE-SAPIN'S 1,500-tpd uranium processing mill at Grants, N. M., produced its first uranium concentrate Aug. 1. After a brief break-in period and minor alterations, the mill placed one 750-tpd unit in continuous operation Aug. 8.

Homestake-Sapin Partners is a limited

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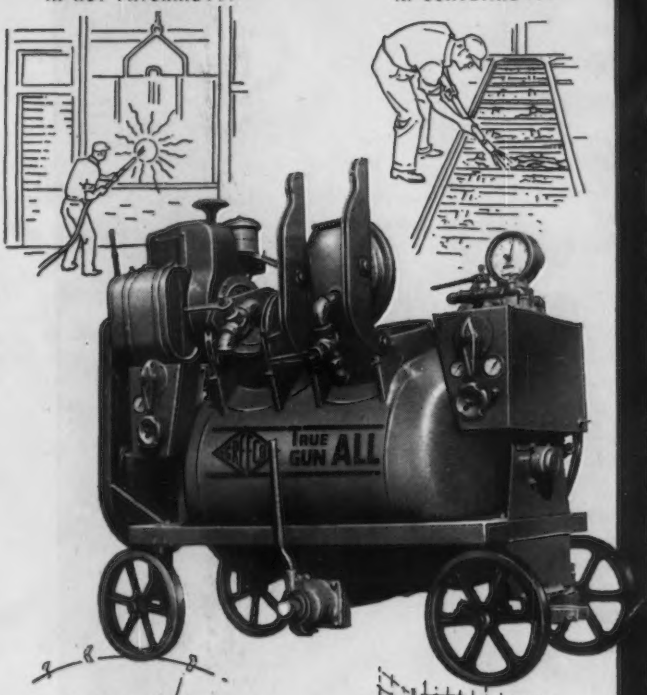
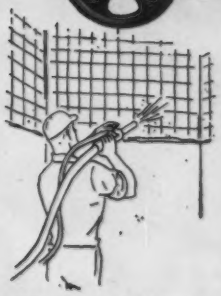
IN CONVEYING . . .





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Here, at last, is a *true* all-purpose, wet mix refractory gun, handling a complete range of materials for *all* applications.

The GREFCO TRUE GUN-ALL allows *faster*, easier and more economical placement of GREFCO refractory products:

- CHROME GUN MIXES
- HIGH DUTY FIRECLAY MIXES
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Do you get service like this?

USS Rolled Plate Lining mills 1,000,000 tons of gold-bearing ore before being replaced

HOMESTAKE MINING COMPANY, Lead, South Dakota, grinds gold-bearing quartz, two-thirds of the ore being of unusually hard rock. The ball mill produces a grind to pass 65% through 200 mesh.

Recently, the #2 unit in the ball mill was relined and performance of the previous 26-month-old USS Rolled Plate Lining was evaluated. The heavy lining consisted of 24 tons of 3″ plate and 5″ lift bars. It was in operation 773.75 days and milled 1,051,034 tons of ore, an average of 1,358 tons per operating day.

Because USS Rolled Plate Linings are made of *rolled* steel, they have superior toughness. Lift bars are rolled alloy steel and heat treated to obtain extra hardness and toughness through the lift portion of the lining. Both plates and bars are made to close tolerances for snug fit.

Our technical personnel will be glad to advise on any tough grinding problem.

Original lift was 2½″. Lift remaining at replacement measures a full 2″. Liner plates are worn to less than ¼″ in the valleys. There was no evidence of breakage in either plates or bars.

United States Steel Corporation – Pittsburgh
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Export Company

USS TRADEMARK

United States Steel

Homestate (*Continued*)

partnership with the Homestake Mining Co. and the Sabre-Pinon Corp. Homestake is the general partner with a 25% interest, and Sabre-Pinon the limited partner with a 75% interest. Ore for the new mill is being supplied from the partnership's properties in the Ambrosia Lake area.

Mining developments on these properties during recent months indicate that previous estimated production will be substantially increased, said Richard D. Bokum II, president of Sabre-Pinon, who authorized the release of custom ore purchases for the new mill.

Bokum said, "In view of the increased tonnage of its own ores now available, Sabre-Pinon Corp. considers that the purchase of custom ores is not necessary for the operation of the Homestake-Sapin Partners mill."

Chloride Volatilization For Lead Ores Developed

HIGH RECOVERY of lead, gold and silver from Eureka, Nevada oxidized lead ores has been obtained in chloride volatilization experiments conducted in Bureau of Mines laboratory. Ore, running 14.6% Pb, 0.4 oz Au and 6.8 oz Ag from Eureka Corp. Adams Hill mine was used in the test.

Eureka Corp. has developed some 53,000 tons of reserves, but the ore is not amenable to conventional concentration and extraction methods due to the presence of magnesia and arsenic.

Laboratory tests resulted in recovery of 99% of the Pb, 98% of the gold and 96% of the silver with only 6% of the arsenic being volatilized.

Other deposits in the Eureka area contain similar ore. According to Bureau of Mines Report of Investigation No. 5409 by A. L. Engel and H. J. Heinen, some antimony and zinc were also recovered. Reagents used were varied, but the best results were obtained with $CaCl_2 2H_20$ (at 300 lb/ton) was used in a chloride roasting at 1,000 deg C.

French Guinea Alumina Agreements Are Signed

OLIN-MATHIESON CHEMICAL CORP., Pechiney and Ugine, British Aluminium, and Aluminium Industrie AG, of Switzerland, have signed agreements for the financing of a $135-million alumina project in French Guinea.

Operating as Fria (Cie. Internationale pour la Production de l'Alumine), the combine will construct an alumina plant with an initial capacity of 480,000 tons, a railway line, housing, mine installations and port facilities.

The plant, located some 80 miles from Conakry, will treat bauxite from nearby deposits whose proved reserves are around 1½-billion tons. Operation is due in 1960, with initial production of 480,000 tons to be eventually hiked to 720,000, and then to 1.2-million as the owners' needs increase.

The Fria plant is only one of a series of international aluminum projects now under study. (*E&MJ*, August, p 18.)

International Mining Session Planned Oct. 30

THE 1958 International Mining Days will be held in Carlsbad, N.M., Oct. 30 to Nov. 1. New Mexico Mining Assn. will join the Southwest International Mining Assn. under the chairmanship of R. G. Haworth for technical sessions and social events and T. O. Evans in charge of the conference program.

Thursday, Oct. 30, will consist of registration and technical sessions. Morning and afternoon sessions will occupy Friday, Oct. 31, with a luncheon and special meeting of the New Mexico Association. Saturday, Nov. 1, both the ladies and men will be included in the ranch style breakfast, the field trips and the suppliers' party.

Drilling and Blasting Session Set For Oct. 2

TOP SPEAKERS from industry and equipment manufacturers will participate in

Thoroughbreds for your string!

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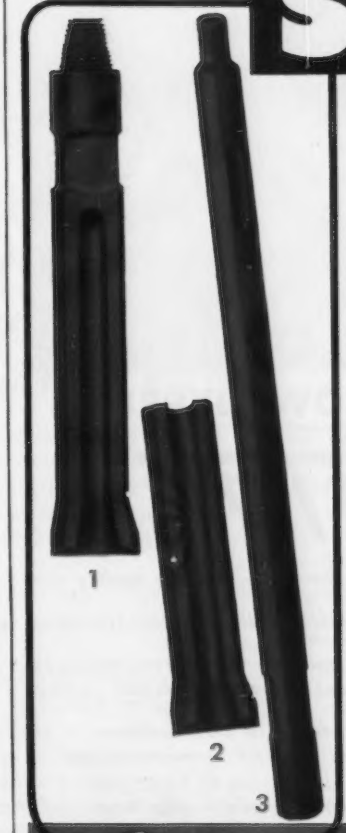
Sure winners in performance and production! Spang Bits and Stems, developed by skilled experts, are a safe bet to pace the field in long service and economy. Win, place or show you can be sure with Spang.

① SPANG CHURN DRILL BITS drill more holes per bit at lower cost! Fully heat-treated, high carbon, molloy steel, or 4340 steel. They have added strength in pin and blade sections to enable them to take the toughest drilling conditions in stride. Semi-dressed ends speed finish-dressing.

② SPANG REPLACEMENT BLADE SECTIONS are for welding to the pin and collar sections of the original bit when it has become worn from long service.

③ SPANG INTEGRAL ROPE SOCKET TYPE STEMS with heat treated swivel socket and swivel. Drill more . . . drill longer for less with these rugged, efficient stems. Made from one bar of steel with only a threaded box joint with integral rope socket top the stem's uniformity cuts vibration or whipping. Tools turn freely in the open swivel socket keeping the hole round and straight.

Your inquiries are welcome— contact your nearest Spang dealer or write direct to:



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For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

Symposium *(Continued)*

the Eighth Annual Drilling and Blasting Symposium, Oct. 2-4, at the University of Minnesota campus in Minneapolis.

Included among the subjects to be covered, according to joint announcement by U. of Minnesota, Colorado School of Mines, and Penn State, will be: use of vertical or horizontal holes in strip mining; Western practices in rotary drill use; 9-in. drill development; drill steel investigations; use of ammonium nitrate in the U.S. and in Canada; milli-second delay blasting; photographic study of blasts; chip generation; energy transfer in percussive drilling, stress-wave measurement; explosives research; new ideas and techniques in drilling and blasting; and European practice.

Further information may be obtained from Prof. E. P. Pfleider, chief of the division of mineral engineering, University of Minnesota.

Korea Tungsten Mining Faces Nationalization

TWO ALTERNATIVE PLANS have been put forward by the Korean ministry of commerce and industry to nationalize the Korean Tungsten Mining Co. The two plans, set up to end the loss operation of the company, include the following:

1) Completion of the chemical processing plant to produce 158 tons of refined ore from 80,000 tons of ore monthly, restriction of output to the latter figure, and release of 650 to 700 production employees.

2) Separation of the Talsong and Tangchi-ni mines from Korea Tungsten Mining and operation of the Sangdong mine only, on a limited basis of 220 tons of refined ore monthly. Under this plan, 550 to 600 KTM employees would be released.

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ALASKA

The Alaska Statehood Act amends a portion of the Merchant Marine Act (1920) in such a manner as to repeal the Jones Act—foreign ships may now ship between U.S. and Alaska, and between Alaskan ports. Alaskans have long held that this would do more than anything to reduce costs for the Alaskan miner.

U.S.G.S. has moved its Anchorage office to the Denali Building at 4th and B Sts.

U.S. Bureau of Mines reports on the Hannum lead prospect (Fairhaven District in Seward Peninsula) on open file at Juneau station (Douglas side of the channel).

A Japanese commission from large steel interests is due in Alaska to investigate coking coal deposits in the Bering River area for export to Japan.

Holders of claims in the following areas have 150 days from the starting date of publication shown below to file verification statements that they wish to retain exclusive surface rights to their claims—

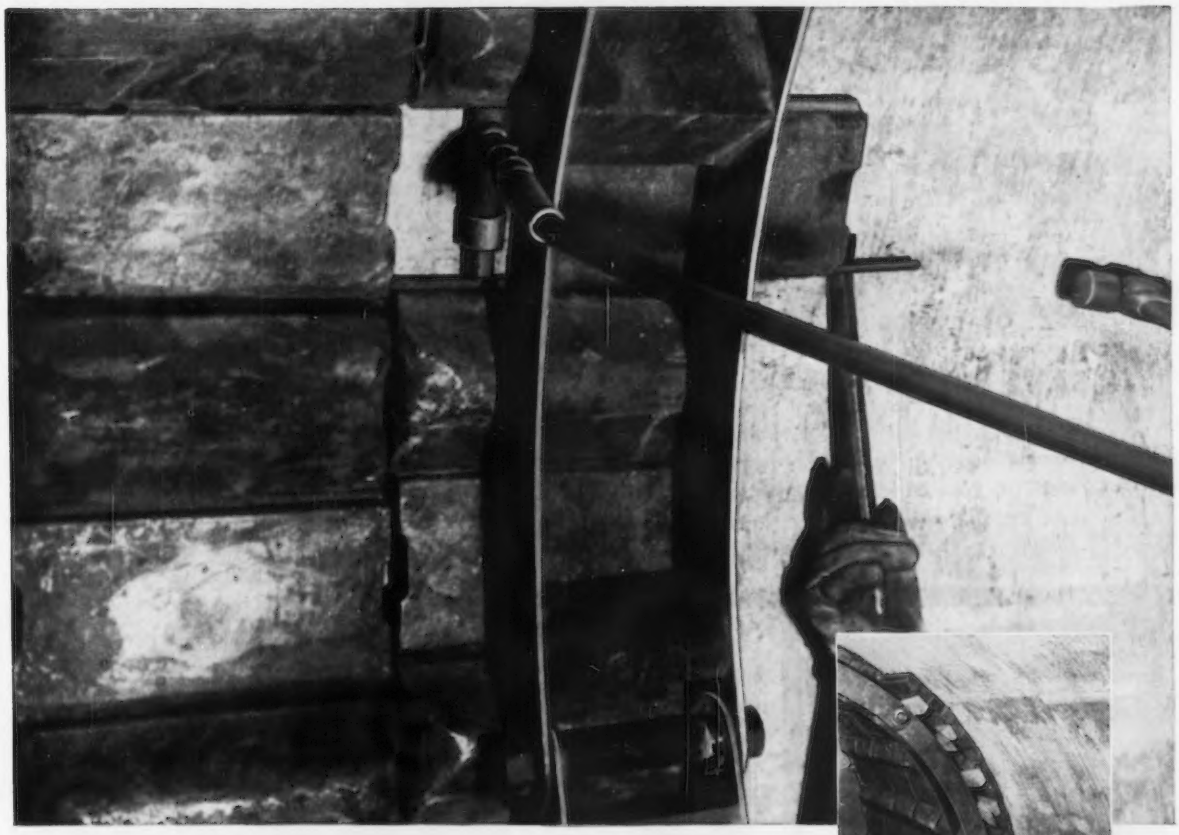
Iyoukeen Cove—all land within a rectangle bounded on the south by a line through Cannery Point, Tenakee Inlet, on the west by a line through Cannery Point, on the north by a line through the north side of False Bay, and on the west by Shatham Strait. Publication date is July 9, 1958.

Silver Bay—that portion of the Bay south of 57° N, including land within all the side drainages entering this portion of the bay. Publication date is July 9, 1958.

Deep Cove—all land in the vicinity of Deep Cove, Mist Cove, Cliff Lake, Deer Lake, Fawn Lake on Baranof Island. Publication date is July 11, 1958.

Red Bluff Bay—that portion of the west side of Baranof Island from Nelson Island south to an east-west line through the south end of Falls Lake and east to a north-south line through Radamaker Mountain. Publication date is July 11, 1958.

Virginia Lake — all the mainland bounded by a line running from the mouth of the Stikine River up to Shuktuss Creek, then due south to a point



How B&W Standardized Universal Liner Plates Speed Mill Installations

Uniform Castings Fit All Mill Sizes

B&W Universal Liner Plates save manhours and reduce mill downtime because they are quick and easy to install. Since the same casting fits all mill sizes, B&W standardization also means lower costs, higher performance, longer life and less breakage in your operations.

Here is the simplified installation procedure:

1. Lay liners in bottom half of the mill with the desired lifter centers.
2. Then, place in position a simple installation form and complete the ring of liners without turning the mill. The last casting in each ring is wedged tightly into place by means of a hydraulic ram and locked with a pin. The joints are designed to permit the use of a spacer pin where needed. The number of pins in a ring depend upon shell variations and lifter centers used.

With B&W Universal Liner Plates, direct labor cost and installation downtime are reduced. Small, lightweight castings are easily handled, minimizing worker fatigue and eliminating the necessity for cranes. Also, B&W Universal Liner Plates give longer life of greater usefulness. Uniform wear results from better quality control on a mass production casting with permanent molds. You save money on liner inventory, breakage claims and delays for replacements. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. Costs are also reduced for storage space since small castings stack easily.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. For additional information on B&W Universal Liner Plates, write The Babcock&Wilcox Company, Process Equipment Dept., Barberton, Ohio.

S-472

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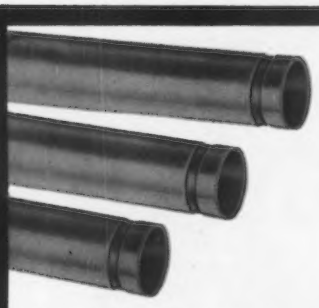
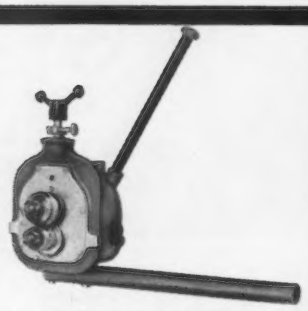


1. LIGHTWEIGHT PIPE in thicknesses from .065" handles high pressures. Leading mills make sizes 1¼" to 12", steel or aluminum, with *VIC-EASY roll-grooved ends.*



2. VIC-EASY PORTABLE GROOVER rolls grooves into pipe in seconds. Manually or power-operated, this groover removes no metal...retains full wall thickness.

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Alaska (*Continued*)

two miles south of the Glacier Basin trail, then east to Aaron Creek, then south to Blake Channel, then along the shoreline to the Stikine. Publication date is July 11, 1958.

A bill passed by the House last year, H.R. 6785 which would permit iron ore mining in the Chilkat River, has been okayed by a Senate Interior Committee subcommittee.

ARIZONA

A barite strike in the Big Horns, about 20 miles south of Aguila, has been announced by William F. Paine, Scottsdale mine and mill management consultant. Paine shares interest in the property with Robert Van Beekman, Morton Braiker and Harry Williams, all of Phoenix. News of their discovery was withheld until filing and assessment work on 12 claims had been completed. Claims originally were owned by Arizona Barite Corp., which Paine managed for 12 years. Its successor company, Macco Co., let the claims lapse.

A history of mining in Arizona is being written by Charles H. Cunning, former head of the Arizona State Department of Minerals and Resources and now a consulting engineer at Phoenix. He has appealed for historical or amusing facts about Arizona mining and invites contributions. His office is 817 W. Madison, Phoenix.

First copper produced at the new $40-million Kennecott Copper Corp. smelter at Hayden has been shipped, two carloads being processed even though the plant is not completed. Another three months' work remains before the entire plant is finished. Kennecott will continue to use the American Smelting and Refining Co. custom plant at Hayden until Fall.

Arizona appropriations to run the state mine inspector's office are inadequate and unfair to miners, says Inspector Roy V. Hersey. His statement followed refusal of the International Union of Mine, Mill, and Smelter Workers to endorse a candidate for mine inspector for the coming primary election, because of "deterioration of the service from the mine inspector's office in past years."

Total appropriation for the mine inspector's office last year was $43,634. Hersey draws $7,200, a dust control engineer draws $6,000 and three deputies receive $450 each a month. Hersey complained the appropriation allows each of his staff only $135 a month for mileage and out-of-town expenses.

CALIFORNIA

Several diatomite claim-holders on the West Side of Kern County are planning exploitations of their properties.

John D. Earls, Bakersfield, has five claims of 20 acres each northwest of Fellows. Diatomaceous earth formation

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Traylor Engineers are building the 10th Traylor 60" TC Primary Crusher for delivery. These mammoth 60" crushers are one of the largest pieces of machinery used by industry, weighing in excess of one million pounds and delivering up to 32,000 tons of product per eight hour day. These giant crushers feature Traylor's original self-tightening bell head and curved concaves, practically eliminating choking and packing. One of the 60" TC Crushers is in use in Minnesota, four in Michigan, one in England, one in Peru, one in Chile and one in Arizona. Put your crushing machinery problems in the hands of experienced engineers. Ask about Traylor-made machinery. For more on TC Gyratory Crushers, write for bulletin No. 1126 today.

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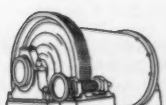
BALL MILLS

ROTARY KILNS

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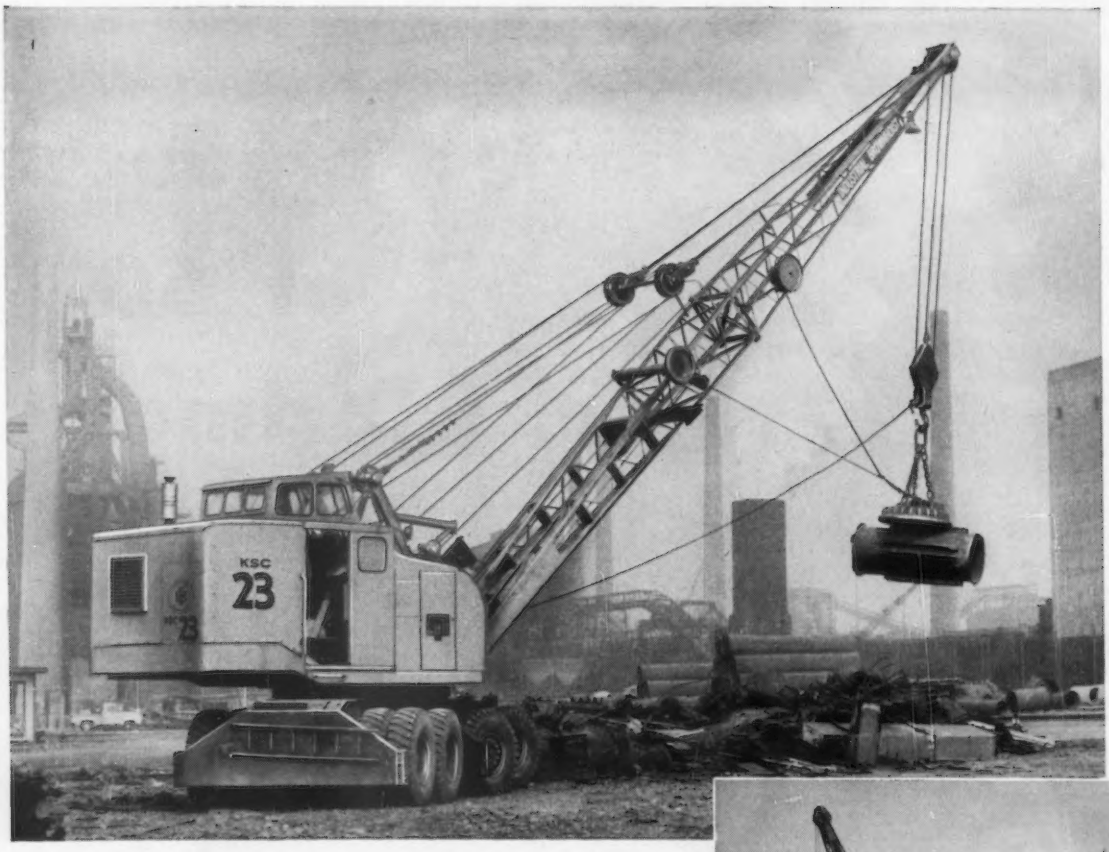

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The 50 Ton Diesel Electric Wagon Crane and the 50 Ton Diesel Electric Locomotive Crane pictured here are two of several Industrial Brownhoist heavy-duty cranes operated by Kaiser Steel Co. at their huge plant in Fontana, California. Although these cranes operate at peak efficiency on a variety of rugged, daily jobs, it sometimes becomes necessary to replace parts. With Industrial Brownhoist cranes, either locomotive or wagon, part replacement is both swift and economical for every part is *interchangeable* from the car body up. The number of parts in your stock can be cut in half and down time for part replacement can be virtually eliminated.

If you need both a wagon crane and a locomotive crane for the heavy-duty jobs around your plant, get Industrial Brownhoist cranes. You, too, will benefit from the interchangeability of parts and such high performance features as exclusive 360-degree monitor-type cab, clear-vision boom, straight line power train and electric rotation for fast operation. Write for further information today.

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BROWNHOIST

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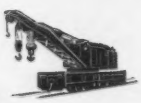
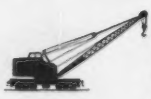

250 TON WRECKING CRANE

COAL-ORE BRIDGE

CAR DUMPER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California (*Continued*)

in the area is about a mile wide and has a dip that varies from 45 to 65 deg, he says. Overburden is a foot or two in depth at most. Mining would be a strictly bulldozer operation, Earls notes.

Joe Mann of Ford City has 120 acres of diatomite claims east of Earls' property. Mann core-drilled to 400 ft over an area of approximately 20 acres and found that his deposit was of commercial value to 85 ft, he reports. Mann also core-drilled claims belonging to the EX-M Co. Their property lies in two parcels.

Irvin Geeslin and Robert Fiscus of Maricopa have diatomite claims near Taft in the 25-Hill area. They, like Mann and Earls, found the diatomite while they were prospecting for uranium.

The EX-M Co. of Los Angeles operates a mill six miles west of McKittrick. Ground and sized diatomite is packaged and sold in five-pound lots in a chain of stores.

Harvey Aluminum, fabricator of aluminum mill products, is starting regular production at its aluminum reduction facility at The Dalles, Ore. Company was to deliver its first commercial output at approximately mid-November, shipping primary metal in a range of specifications to meet any standard or special requirement. Capacity of the new smelter is more than 50,000 tons (240 pots) of aluminum yearly.

Metal-bearing nodules covering the Pacific Ocean floor outside the three-mile limit are worth an estimated $1.5-million per square mile of ocean floor, according to University of California's Dr. Herbert E. Hawkes, professor of mineral exploration—if an economical method of separating and recovering the various metals can be developed.

Nodules, up to two cubic feet in size, cover from 5 to 50% of the ocean floor in some areas. Most of the nodules are under 6 in. dia. They contain many metals. Nodules from the French-owned island of Tuamotu (South Pacific) are said to have assayed 25% Mn, 15% Fe, and lesser amounts of Ni, Cu, Co and rare earths. Suction dredges capable of lifting nodules one foot in diameter from depths greater than 1,000 ft are available, say the scientists, but the processing method is still to be found. There are enough nodules on the Pacific Ocean floor to supply all the worlds' needs of these metals for many years —at least 40-million square miles of ocean floor are peppered with them.

COLORADO

Demand for beryllium, in the next few years, is expected to outgrow the supply of the strategic ore available, a mining expert told a group of beryllium miners recently. Marling J. Ankeny, director of the U.S. Bureau of Mines, Washington, D.C., told some 50 representatives of beryllium firms attending a conference of the Beryllium Association that the metal has a "tremendous future."

CHRISTENSEN DIAMOND PRODUCTS — DIAMONDS *mean greater core recovery!*

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With newly designed Christensen soft formation barrel and long nose pilot bit

This newly designed diamond coring equipment overcomes the problem of poor core recovery in soft, unconsolidated mineralized formations. By coring ahead of the circulating fluid, the pilot bit, in conjunction with the soft formation barrel, protects the core from moving fluid thereby preventing fluid erosion.

In a recent uranium operation at McKinley County, New Mexico, this equipment was used successfully in the Westwater formation, a soft, unconsolidated sandstone, where previously, high core recovery was very difficult, and many times impossible. The operator reports that this equipment recovered *over twice the core* (up to 98%) that had previously been recovered by conventional equipment. In addition to New Mexico, superior results have been obtained in soft iron ore formations in Southern Utah and Northern Minnesota with a slightly smaller barrel and bit. Excellent results have also been obtained in the Wind River formation of the Gas Hills area in Wyoming.

If your problem is obtaining "good" core in soft, unconsolidated formations contact . . .

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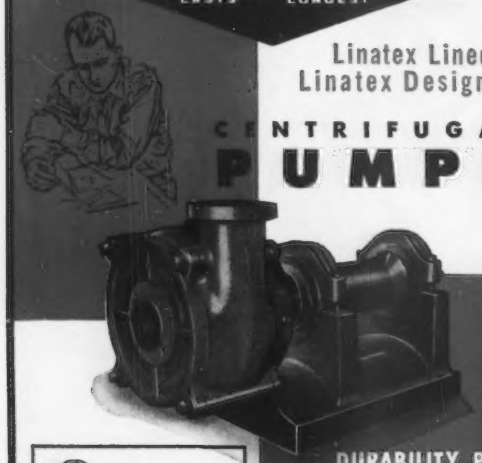

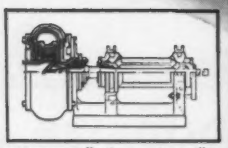

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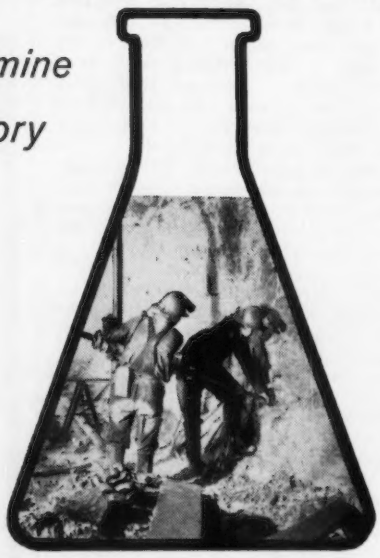

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40 Rector Street, New York 6, N. Y.

Colorado *(Continued)*

"Nuclear scientists and rocket technicians pin some of their fondest hopes on beryllium, its alloys and compounds."

He said about 100 mines produce the entire U.S. domestic supply of the metal —some 460 tons in 1956. Colorado produces about 39% of the domestic ore supply.

Loveland was named as the "coming center of the beryl mining industry," by L. Bernard Davis, president of Mineral Concentrates, Inc. at a meeting held there. Davis spoke to many of the city's leading citizens in short ceremonies dedicating his company's new beryl mill and acceptance of a deed to the property upon which it is located. Mill is located in the industrial site west of Loveland.

He said the area west of Loveland represented "probably the greatest deposit of beryl in the U.S.," and predicted the beryl industry and Loveland would in the future enjoy a solid growth.

Golden Cycle's Ajax mine ore production at Cripple Creek increased substantially during the month of June with a net total of $44,800 in mine ore alone. Net for the month of May was $27,300, making an increase for June of more than 60%. Tonnage increased by one-third with a total of 2,352 tons for the month. In addition, nearly 1,500 tons of dump ore were shipped to the mill.

Company is shipping approximately 80 tpd of ore from their operation on the 3100 level of the Ajax. The orebody, opened up in July, is in the New Market Vein.

Deadwood Mine at Cripple Creek, which shipped more than 1,000 tons of ore in August, ranks behind only the Cresson and Ajax mines in production. It is a United Gold Mines property under the lease of Jerry Muzik and Lloyd Stoner. Some of the workings extend into Free Coinage claims. At the present, the work of both the company and the leasors is confined to the 200 and 300 levels.

The Cresson ore being taken from the 2000 ft level of the mine continues to improve, according to Charlie Carlton, manager at Cripple Creek. The best shipment to date was a shipment of screenings that settled for 1.39 oz Ag per ton.

A 32-ton shipment of cleanup muck was the first shipment for months from the Cameron Mine at Cripple Creek, which was opened recently by the Crest Mining Co. Bert Bielz, Victor miner, is in charge of the operation. Seven men are now employed at the famous old mine which is located on County Highway 50, between Cripple Creek and Victor.

If production warrants the additional expenditure, the Golden Cycle Corp. will move the steel headframe, which was built at the Gold Sovereign a few years ago, to the Cameron.

Nearly $4-million of silver poured into the Denver Mint during the first half of 1958 as the result of the depressed world price of the metal. Receipts

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This is especially true of fire-resistant Thermocoal—the belt that bears acceptance designation #28-13 of the U. S. Bureau of Mines.

You'll not only have a belt that meets or exceeds all after-flame and after-glow tests . . . you'll also benefit from typical Thermoid toughness. Thermocoal Belts are engineered for high resistance to flexing and impact, edge wear, abrasion and mildew. You can specify either 4 or 6 ply construction of the strongest cotton or cotton-nylon duck—impregnated with specially compounded Thermoid rubber stocks to assure longer life, lower costs.

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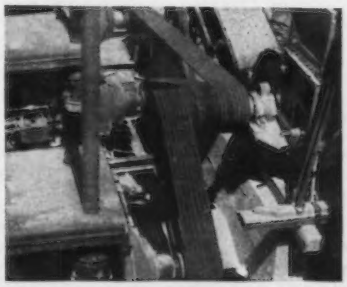

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Sauerman News Briefs

SPECIAL EDITION OF SAUERMAN NEWS

Brief items about the Sauerman Method... Crescent DragScrapers Slackline and Tautline Cableways... Durolite Blocks

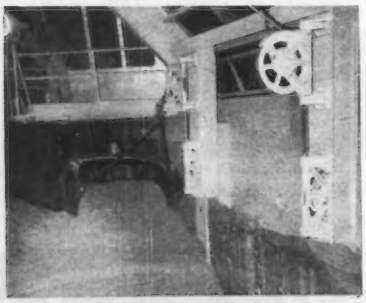
Sauerman Bros., Inc. • 626 South 28th Avenue • Bellwood, Illinois, (Chicago Suburb)

Stockpiling Zinc Residue

Zinc residue from the smelting furnaces of the Meadowbrook Corporation is economically handled by a DragScraper storage machine. About 100 tons of residue are produced daily in the refining processes and the material is carried by belt conveyors to the disposal area. The conveyors feed a swivel spout which forms the initial pile near the head post.

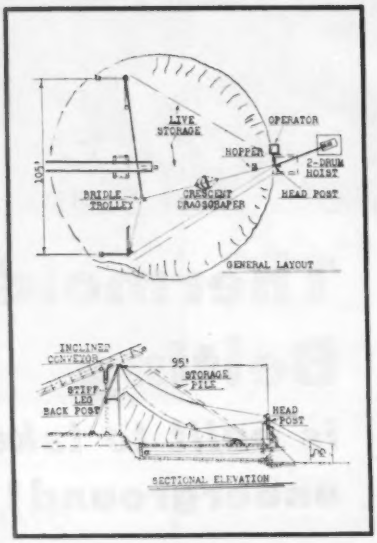
Ample storage capacity is provided by using an elevated bridle system at the outboard side of the disposal area. The elevated bridle cable is supported by two 60-ft. guyed masts about 200 ft. apart. Lateral shifting of the DragScraper is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The height of the mast permits building a 50-ft. high pile and provides storage for 100,000 yds. of zinc residue for each setup of the tailmasts.

(Condensed from Sauerman News No. 152.)



Reclaiming Material to hopper from all sections of a 500-ft. warehouse, the estimated operating cost of this DragScraper Machine is 2.1 cents per ton. *(Sauerman News 145).*

Rapid Shifting DragScraper is Engineered to Needs of Silica Sand Producer



The Sauerman Method was successfully applied to the requirements of a prominent silica sand producer, as shown in the drawing above. This Rapid-Shifting DragScraper Machine reclaims raw sand from a 6,000-ton stockpile.

The pile is formed by an inclined conveyor leading from the floor of the quarry to the live storage area. The Crescent DragScraper reclaims from storage to a hopper-fed conveyor in front of the head post.

Before the DragScraper was installed, the raw sand frequently bridged across the hopper. Such interruptions in the flow of raw sand to the plant resulted in costly shutdowns. The Crescent prevents this bridging action and provides a steady flow of material for processing.

The Sauerman Method also permits the company to build up a reserve pile of raw sand sufficient for at least one week's production as insurance against a quarry shutdown.

(Condensed from Sauerman News No. 147.)

MORE NEWS AND INFORMATION

Issues of Sauerman News giving greater detail about the installations on this page are available on request. For full information, tell us your interest or requirements and ask for catalog. Contact Sauerman Bros., Inc., 626 S. 28th Ave., Bellwood, Ill.

Colorado *(Continued)*

totaled 4,403,885 oz valued at $3,985,133 compared with a trickle of 86,833 oz ($78,662) in the first half of 1957 when the world price was higher.

Whenever the world price falls below the U.S. Government's fixed price of 90½c an ounce, the metal flows to the Government. When the price is higher it goes into commercial channels.

Gold receipts at the mint were up to 352,379 oz worth $12,333,273 in the first half this year from 344,465 oz ($12,056,275) in the like 1957 period.

IDAHO

The controversy over mining rights on an 80-acre portion of Idaho Garnet Abrasive Co.'s property in the St. Joe national forest in north central Idaho will not impede mining operations, according to H. D. Trumbo, Spokane, general manager of the firm.

The Government has challenged the mining rights of the company on the disputed land and Federal district court at Boise issued a temporary restraining order prohibiting shipment of material by the company. The restraining order issued in June was modified July 30 at Boise to permit shipment of material already mined, but the ban on further mining of the disputed area was continued until a final determination of the case is made.

Trumbo said that in addition to the disputed land in the national forest area, the company owns some 700 acres in the vicinity which he said contains enough garnet deposits to handle the firm's market needs for the next 100 years. Mining operations will continue on the undisputed land, Trumbo said.

Anaconda Co. has accelerated exploration activity in the alumina-rich clay deposits in the Moscow-Deary area of Latah County. Additional shaft miners from Butte have been assigned to sink a number of shallow shafts on the N. T. Carson ranch north of Moscow to determine the thickness of the deposits and obtain bulk samples for tests in the pilot metallurgical plant at Anaconda which is now nearing completion.

Calera Mining Co., a subsidiary of Howe Sound Co., has executed a contract with the Defense Minerals Exploration Administration for an extensive cobalt-copper exploration project at the Sunshine claims adjoining its Blackbird cobalt-copper mine in Lemhi County. Total expenditures under the contract are estimated at $104,200, with Federal participation of 62½%.

Plans for extensive development of large placer holdings in the Florence Basin of Idaho County have been announced by Idaho Mining & Milling Inc. of Lewiston, a corporation organized last March. Company has 20 miles of stream bed which has never been touched by modern equipment in the area which was the site of Idaho's first gold strike in 1861. Testings have indicated values of more than $3 a cubic yd and plans

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The Wemco-Remer Jig:

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The operating capacity — and results — of the Wemco-Remer Jig are more than ever a profit factor in the world's large operations.

The reason: sharper separations at larger tonnages than heretofore possible. Its new principle, differential acceleration, combines the conventional jig stroke with high frequency vibration. Results: uniformity of jigging action through long uninterrupted flow of material; complete stratification prior to final separation; increased hutching capacity for removal of finest mineral values as concentrate.

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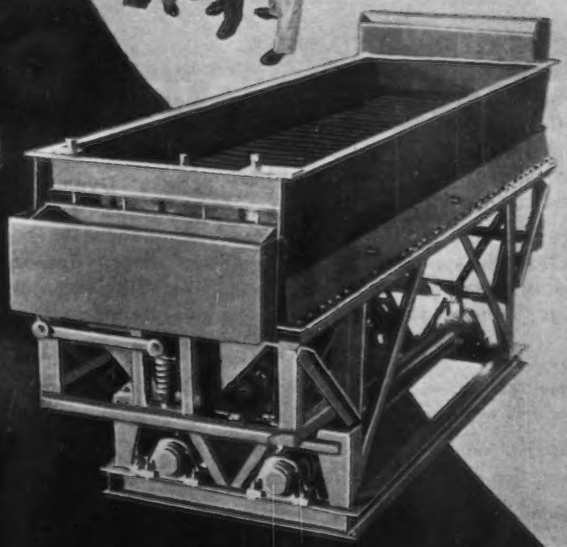

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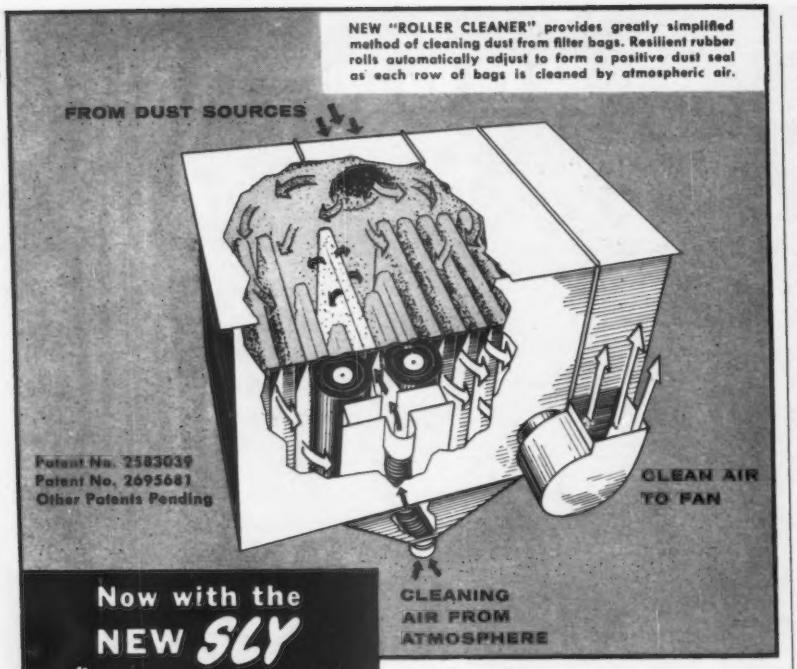
NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.
FROM DUST SOURCES
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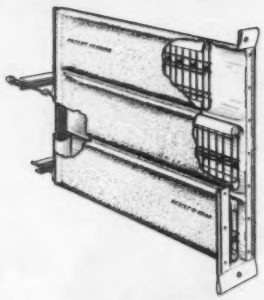
Other Patents Pending
CLEAN AIR TO FAN
CLEANING AIR FROM ATMOSPHERE

Now with the NEW SLY "ROLL-CLEAN" DYNACLONE



As much as 3 TIMES LONGER BAG LIFE

NEW SLY "RESIST-O-WEAR" FILTER BAGS (patent pending) provide complete dust filtration with as much as three times longer life than conventional bags. This has been proved on the toughest field installations.

The new bag has three equal-size sections. Each pocket has two spacers, making a total of six per bag. Weight is distributed on three seams rather than one, minimizing strain. A special protective flap on the back end prevents abrasion from incoming dust.

Now standard in the new "Roll-Clean" Dynaclone, Sly "Resist-O-Wear" bags combine with all the other superior Dynaclone features to assure greatest dust collecting efficiency with unequalled maintenance-free service.

ALL THESE FEATURES IN ONE DUST FILTER

- New "Resist-O-Wear" bags last as much as three times longer.
- Constant suction at dust sources—complete dust collection.
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SEND FOR New Bulletin 105 and New 36-page Dust Control Catalog 104.

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THE W. W. SLY MANUFACTURING CO.

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OFFICES IN PRINCIPAL CITIES

Idaho (*Continued*)

are to install a shallow-type bucket elevator dredge with a capacity of 2,000 yd a day.

Silver Buckle Mining Co. has nearly completed stripping overburden from its uranium ore deposit on the Spokane Indian Reservation in Southern Stevens County, Wash., and expects to be making shipments to the nearby Dawn Mining Co. processing plant by early August.

Polaris Mining Co. has undertaken two new exploratory diamond drill holes in its extensive silver belt holdings south of Osburn in the Coeur d'Alene District. One hole is being angled downward from the 3,000-ft level of the Silver Summit Mine to cut the big Chester vein at an additional depth of about 650 ft for the purpose of determining whether the St. Regis formation, a more favorable host rock for ore deposition, has replaced the Wallace formation on the footwall side at that horizon. The other hole is being extended southerly from the 3,000-ft level workings in Rainbow Mining & Milling Co. property into the adjoining Triangle ground which is owned by American Smelting and Refining Co. and Day Mines Inc.

Nuclear Fuels & Rare Metals Corp. Inc. has been incorporated under Idaho laws to explore and develop reserves of radioactive thorium ore in the Lemhi Pass area, Lemhi County, that are believed to be the largest in the U.S. Company, headed by D. B. Lewis of Los Angeles, now controls some 7,500 acres in the area and reserve tonnages are estimated to be in the millions. Plans and preparations for a large open-pit mining operation are now in progress. Extensive development work in the past indicates that the ore contains from 1 to 20% thorite, with an abundance of columbium-tantalum, zirconium and rare earths.

Salmon River Scheelite Corp. has resumed exploration at its tungsten property on Thompson Creek in Custer County with the objective of completing the $90,000 DMEA project approved and started last year. Diamond drilling last fall indicated a substantial width of commercial-grade ore on one of the Nelvinny claims, which will be opened and explored by drift with the remaining project funds. Robert M. Barrett of Salt Lake City is now operating the property under a sub-lease contract and Frank A. Taft is his manager.

KENTUCKY-ILLINOIS

The latest and fastest-moving mining operation in the entire district is the barite development of Mico Mining and Milling Co. in Crittenden County, Ky., bordering the Ohio River. Four barges of finished barite, strip-mined in the area and processed in the company's new concentration mill, have been shipped from a newly-constructed loading terminal on the Kentucky shore, opposite Cave-in-Rock, Ill.

BILL'S IN A SIZZLE

an ordinary tire "blew" the job

but BOB'S ON SCHEDULE with

U.S. ROYAL SAFETY 1st TRUCK TIRES

service-proved against job delays!

Here's a fact proved at strip mines, sandpits, quarries and construction projects by the hundreds. The best way to prevent costly tire delays and keep hauls *on schedule* is to use U. S. Royal Off-Road Tires!

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Find out exactly how easily and quickly *you* can cut job delays with these service-proved tires. Call your U. S. Royal Dealer. Or better still —specify "U. S. Royal" on your next new equipment!

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B. C. Court Rules Against Mineral Tax Bill

BRITISH COLUMBIA'S Mineral Properties Taxation Act, which has been the cause of continual controversy since its passage in March of 1957, has been found illegal by B. C. Supreme Court.

Justice Harry Sullivan has ruled the act is ultra vires of provincial jurisdiction. Known as Bill 87, the law authorized imposition upon owners of minerals within the province of an annual tax up to 10% of the assessed value of their minerals. (A subsequent order-in-council placed a tax of 8% on the value of iron ore; concentrates and iron products.) It was introduced to discourage export of iron ore to Japan.

News of the court's ruling was hailed by mining circles who have attacked the legislation ever since its passage.

Justice Sullivan, in his judgment, sharply criticized the provincial government for exceeding its authority in imposing the tax which he termed "clumsy and insensible." However, spokesmen for the government have indicated the Department will appeal the decision.

Application to have the act thrown out was made by two mining companies, Utah Company of the Americas and Texada Mines Ltd. The Utah Company operated an iron mine at Iron Hill on Vancouver Island, and Texada Mines, an iron mine on Texada Island. Utah had been assessed $294,846 on its property and Texada Mines $585,291.

The companies argued that the law should be disallowed on four grounds: that it contravened the federal-provincial taxation agreement; violated Canada's obligations under the General Agreement of Trades and Tariffs; was injurious not only to persons within the province, but those outside B.C.; and usurped fields of legislation reserved to the government of Canada.

Mr. Justice Sullivan found that while the professed purpose of the legislation was to impose a property tax to bring in a revenue, the real purpose was to impose an embargo on the export of ore.

"One would be very gullible indeed to think that the purpose of the act was the raising of revenue," declared His Lordship.

He noted that both Premier Bennett and Minister of Mines, Kenneth Kiernan had stated the primary purpose of the act was to discourage the export of iron ore.

The judge held the real intention was to place a virtual embargo on the export of iron ore from B.C., and to encourage or compel the mining industry to provide facilities for melting and refining the ore.

The tax was not a property tax, in his opinion, but was an export tax which is an indirect tax and not within the competence of the legislature.

Industry reaction was unanimous. Larry Postle, president of the B.C. Mining Association, said: "The mining industry feels that if the decision is sustained on appeal, it will lead to an early resumption of prospecting and development of B.C. iron ore. This in turn will probably lead to sufficient commercial reserves to warrant establishment of a steel industry here if and when the markets become available."

A spokesman for Utah Company of the Americas, said: "The judgment is good news to us, but the essential thing is that it will raise the spirits of mining companies to the possibilities in B.C."

"This is great news," said James Scott, president of Empire Development Co. Ltd. which has a $10,000,000 contract with Japan. Empire Development is the only company currently mining iron ore in B.C.

"We weren't very happy about the tax, which was a terrific burden on us in our contract to ship a million tons of ore to Japan," said Mr. Scott.

(Empire last year signed a contract with Japanese interests to ship 1,000,000 tons of ore over a period of three years. So far about 100,000 tons have been exported.)

Dr. Chris Riley, vice-president of the B.C. and Yukon Chamber of Mines commented:

"Both as a mining man and an official of the Chamber of Mines, I am delighted with the judgment. We have continually fought Bill 87 which was the worst piece of legislation to be passed by the B.C. government.

"It stopped a number of mining companies from coming into the province, and others curtailed exploration. I know of three firms, among them U.S. Steel, which were interested in B.C., but backed out because of the legislation.

"When you tax the ore in the ground, it puts mining companies off right away. The mining industry of Canada looked on this as a piece of vicious legislation."

Ill.—Ky. (*Continued*)

Original prospecting and research began two years ago, but only 7½ months from the time construction started in September 1957 the mill was in operation. The loading dock, of 250-ton per hour capacity, was completed early in July.

Crude ore, stripped with a No. 977 Traxcavator, is trucked to the washing-crushing-sizing mill, dumped into a primary breaker for 4-in. sizing, sent through a log-washer, into a secondary breaker, and into a 40-in. Wemco dewatering screen; and then moved by conveyor belt to the jig mill and storage bin. Mill capacity is 75 tons per hour.

The operation employs 14 men, working 2 shifts, on a 5-day schedule.

Truck-loading equipment at the storage bin handles from 12 to 14 tons in 3¼ minutes. Trucking to the river terminal is under contract.

Mico Co., incorporated by a group of St. Louis investors, has 2,500 acres under lease. Albert W. Bailenson, of St. Louis, is president. Company offices presently are at Marion, Ky., but a new office building is under construction at the mine.

Aluminum Co. of America has exercised 12 additional options on property in western Kentucky, lying along the Ohio and Tradewater Rivers in Crittenden and Union Counties. Options acquired by the company last year totaled 93 on 12,000 acres of land. The total number exercised thus far is 33, covering 7,065 acres at a total cost of $1,143,182. Property is being acquired as a site for a smelter and power plant in some possible future development in accordance with long-range plans. The largest parcel on which an option was exercised was that of Mid-Continent Coal and Coke Co., formerly properties of Bells Mines, to assure additional fuel reserves.

Omar Austin, of Elizabethtown, Ill., has leased the flotation mill of Rosiclare Lead and Fluorspar Mining Co. at Rosiclare for production of acid grade fluorspar and started operation August 1. Mill has been inactive since 1954. Crude ore, mined from two tracts of the Interstate fluorspar property, in Hardin County, which Austin has under lease from the company, will be milled.

Late News Briefs . . . .

An overwhelming vote which appeared to be nearing a ratio of five to one by the citizens of Alaska affirmed its future role as the 49th United State. The territory is expected to hold a general election within the next few months. When those results are certified to President Eisenhower, he will proclaim the acceptance of the new state, probably early in 1959.

One million tons of taconite ore (about one month's mill feed) was broken at Babbitt, Minn., by Reserve Mining Co. Blasters used some 625,000 lb of explosive in 794 holes.

The mining industry, following the defeat of the Seaton Plan in the House after strong Senate support, is studying the other avenues of support remaining. Tariffs, barter, and another subsidy try at the next session are all being talked about. See p 20.

SEVEN SIZES—½ to 50 HP—420 to 5 rpm—single and two double reduction ratios. Output torque ratings up to 31,500 lb-in.

FALK ALL-STEEL Shaft Mounted Drives

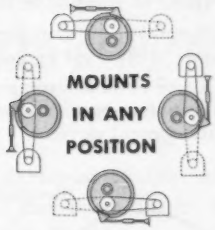
Wherever you require a highly efficient, economical speed reducing unit to fit into a limited space, the FALK All-Steel Shaft Mounted Drive meets your needs perfectly. This rugged, compact reducer mounts directly on the driven shaft and is driven through V-belt or chain drive from any convenient rotating power source.

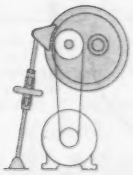
It's hard to match the versatility of a Falk Shaft Mounted Drive. You can choose a single or double reduction unit and use it with any of the many possible sheave or sprocket ratios to obtain almost any specified speed between 420 and 5 rpm. Equally important, the standard Falk Shaft Mounted Drive is available for horizontal and vertical application. Delivery is immediate, installation is quick and easy.

These units are completely FALK-designed and FALK-built for a long life of dependable, trouble-free service. *Precision-cut helical gears of highest efficiency* are employed for efficient, quiet operation.

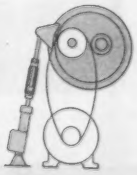
Always available promptly from factory and distributor stocks, from *coast to coast*. For details, ask your Falk Representative or Distributor—or write for **Bulletin 7100.**

A FEW OF THE MANY APPLICATION FEATURES





VARIABLE SPEEDS through use of variable-pitch sheaves—automatic belt adjustment with tie-rod adjustment



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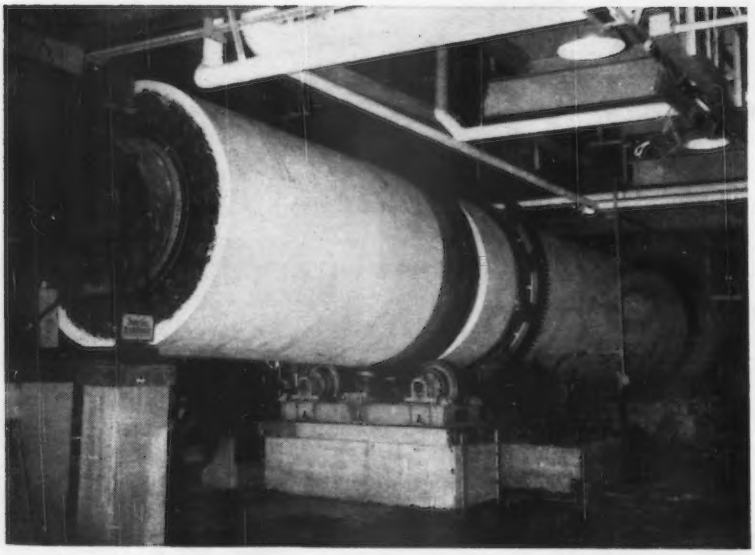
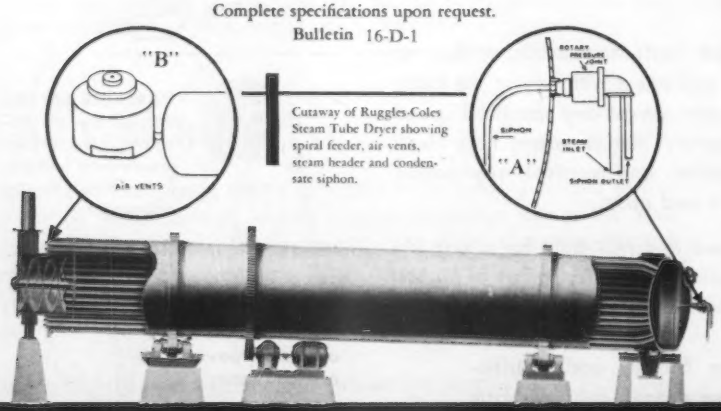


Ruggles-Coles STEAM TUBE DRYERS

- Ruggles-Coles Steam Tube Dryers have been supplied fabricated of aluminum, nickel, monel, inconel, stainless steels and other alloys to provide protection against corrosion and contamination. All fabrication is to code requirements.
- The continuous siphon discharge of condensate is independent of speed of rotation of the shell. (See "A")
- Automatic air vent for each tube eliminates loss of tube heating surface at the feed end of the dryer. (See "B")
- These extra advantages of the Ruggles-Coles Dryer mean continuous maximum output without operating attention and elaborate control devices.

Complete specifications upon request.
Bulletin 16-D-1



Cutaway of Ruggles-Coles Steam Tube Dryer showing spiral feeder, air vents, steam header and condensate siphon.

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MICHIGAN

After having shipped 70,000 tons this season, The Buck mine of Pickands, Mather & Co. on the Menominee range was closed at midnight, July 24, for an indefinite period. About 185 men were laid off. Pumpmen and underground maintenance crews will be retained. Shipping will continue from the mine's large stockpile and it is hoped it may be cleaned up by fall. The Buck group includes the Buck, Zimmerman and Fogarty mines in Caspian and Gaastra. The group shipped 390,084 tons in 1957. In addition to the Buck, the Tobin, Book and Warner mines have suspended operations. Menominee range mines still operating are the Sherwood and Bristol of Inland Steel Co., and the Homer, Wauseca, Hiawatha No. 1 and No. 2 and the Cannon of the M. A. Hanna Co.

Howard M. Graff, manager of ore mines for Inland Steel Co., has announced that the company's Sherwood and Bristol mines on the Menominee range are scheduled to produce about the same amount of ore this year as was shipped in 1957. Mr. Graff stated that Inland's ore mining division could produce less than one-third of the company's normal annual requirements for iron ore.

The Michigan Conservation Dept. has consented to a proposed diversion of limited quantities of water from the west branch of the Sturgeon River in Dickinson county, by the Hanna Coal & Ore Corp. The water is to be used for the beneficiation of low grade iron ore at the Groveland mine plant near Randville.

M. A. Hanna Co. is conducting a more active mining and construction program on the Menominee range than are most other companies. Included are development work at the new Homer-Wauseca hoisting shaft which, when completed, will replace the two old shafts: one at each mine.

Also some preparatory work is being done at the Groveland low grade pit, now being developed. Bechtel Corp. of San Francisco, employing over 200 men, has a contract for the engineering and construction work at the Groveland property. The plant building is about completed and machinery foundations and other buildings are being constructed, while the Hanna Co. is developing the pit. Heavy equipment will be installed during the coming winter and the property is scheduled to be ready for operation in 1959.

MINNESOTA

Oliver Iron Mining Division's Sherman group crushing and sizing plant near Chisholm has a capacity of 40,000 to 50,000 tons per 24 hours. The ore goes through primary and secondary crushers. It is screened to make a product in which the coarse ore runs from ½ in to 4 in. with an allowable percentage of fines (minus ½ in). The plant requires 150 men for three shifts, including nine

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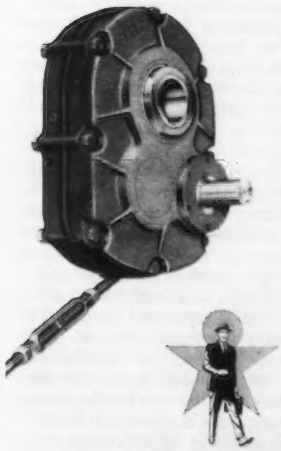

Extreme ruggedness and top quality are built into every detail of the Dodge Torque-Arm Speed Reducer—from the specially heat treated helical steel gears to the corrosion resistant semisteel housing. Broad demand has made it necessary to add sizes until today Torque-Arm is America's most complete (and most widely used) line of shaft-mounted speed reducers. Capacities range from 1 to 100 hp; output speeds from 12 to 378 rpm.

Torque-Arm is mounted on the driven shaft, in any vertical or horizontal position. It is anchored by the torque-arm fastened to any fixed object. No need for foundation, flexible coupling, sliding base. No lining up difficulties. The unit is driven through any V-belt drive. Savings up to 1/3 are possible and Torque-Arm's efficiency is high. It delivers 97% efficiency in double reduction models; and almost 99% in single!

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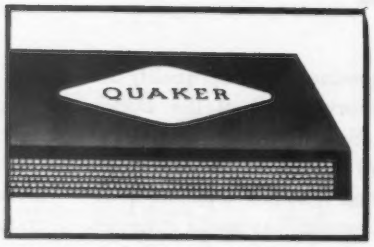

Cross-section Quaker No. 1 grade conveyor belt; 6-ply N-50 heavy cotton-nylon fabric, skim-coated between plies.

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Minnesota (*Continued*)

men on the locomotive ore trains. The Sherman group includes the Alworth, Forster, Fraser, St. Clair, Hartley, Hartley-Burt, and Sherman Oliver company mines. Area of the group (including other mines opening into the group) is 832 acres, maximum depth is 425 ft and the pits contain 24 miles of railroad track. About 245-million tons of waste material have been moved; ore shipped to Jan. 1, 1958, 115,818,000 tons and 1957 shipments were 4,483,000 tons.

The Mississippi group of mines operated by the M. A. Hanna Co. won the 1957 open pit national safety competition sponsored by the Bureau of Mines. The group worked 628,549 man-hours without a lost time injury, and will be presented with a bronze "Sentinels of Safety" trophy later in the year, also "Certificates of Accomplishment in Safety" to the Mississippi group of employes, averaging 320 men. About 100 open pit mines competed for the Sentinels of Safety award during 1957.

The U.S. Department of the Interior has received bids for the construction of a new $1,719,000 research laboratory at Fort Snelling, recently authorized by Congress. It will be a charge of the Bureau of Mines and will have a 74,000 square ft, three-unit research building with a pilot plant wing, and a three story crushing plant. The Bureau plans to carry on research work designed for further investigation of minerals in Minnesota, Michigan, Wisconsin, Iowa, Indiana, Illinois, North and South Dakota and Nebraska. The research will include work on low grade manganese ores of the Cuyuna range; non-magnetic taconite; Lake Superior area iron sulphide ores; nickel-copper-cobalt ores and titaniferous magnetic ores.

In a talk at the Hibbing Chamber of Commerce, Stephen E. Erickson, director of beneficiation for the M. A. Hanna Co., said that new and different types of concentrating plants must be developed for Minnesota ores to meet the competition of high grade ores and concentrates available from other sources. "Prior to 1954," he said, "it seemed that any ore with a reasonable iron content could be sold. At about that time high grade ores from other domestic and foreign sources, superior in quality to Minnesota ores, became available in sufficient quantities to lower the competitive position of Minnesota's standard ores. By the radical step of fine grinding of ore material and the combined heavy media and reduction roasting process, which appeared to be the most favorable economically, we can meet and even exceed the quality of ores going to furnaces from outside Minnesota. But whether this can be done on an economic basis depends on further technological advances in the design and installation of huge new processing plants; constantly improving employee productivity, and an encouraging and intelligent tax and business environment."

William K. Montague, Duluth, counsel for the Lake Superior Industrial Bureau,

Minnesota (*Continued*)

an association of Minnesota mining companies, addressed the legislative interim committee on iron ore in St. Paul July 10. He said that "a radical change in the attitude of Minnesotans and in the state's taxing system are necessary to prevent a decline in development of the state's low grade ores. He emphasized that production of iron ore from sources outside of Minnesota has increased rapidly in recent years. Last year the state's share of the nation's iron ore market was less than 50% as compared to over 65% a few years ago. He said that the percentage of Minnesota ores requiring treatment in costly concentrating plants has increased to about 50%, and urged that the state place the iron ore industry on substantially the same basis as other state industries.

The Pierce mine of the M. A. Hanna Co. in old North Hibbing which began stripping operations Aug. 14, 1957, with the big dragline and 3-mile belt conveyor, has moved more than 3-million cubic yd. to complete the program, about 7-million cubic yd more of surface must be stripped in addition to about 15-million cubic yd of rock and lean ore. The dragline operated until December last year. A new 90x220-ft shop building has been constructed at the Pierce, housing a truck and tractor repair shop, wash rooms, welding and machine shops, electric repair shop, warehouse, offices and a change house. Plans for the future include a beneficiation plant which will have heavy-media (both coarse and fine), and spirals.

The M. A. Hanna Company's Hunner mine at Coleraine has completed a 30 x 34-ft addition to the shop building. It houses the welding shop and provides additional room for the machine shop.

MONTANA

An examination of unpatented mining claims by geologists and mining engineers of the Forest Service's Region No. 1 headquarters in Missoula began July 22 in the Gospel Hill area east of Deer Lodge National Forest. There are an estimated 1,000 to 2,000 unpatented claims in the area.

Four examiners will work in the 129,000 acre area for about a month to determine the extent of mining and prospecting activity.

The surface rights examination is being conducted under the Multiple Use Mining Law passed by Congress July 23, 1955, in order to expedite management of public lands. The law "does not interfere with the rights of miners and prospectors to locate claims and develop mineral resources. Rather, it is designed to benefit both the public and the miner through efficient administration of resources," says the Forest Service.

Under the law the Forest Service has the right to manage the surface vegitation of unpatented mining claims. The examination now undertaken is to determine the surface rights of claims es-

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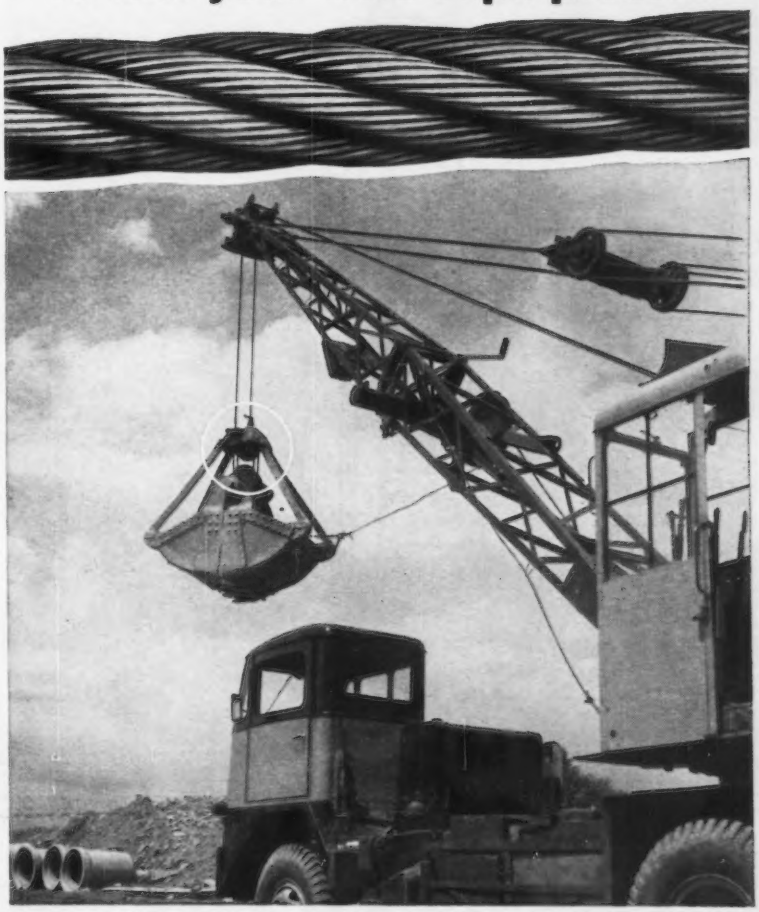

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Montana (*Continued*)

tablished prior to the enactment of the new law and does not affect the miners or prospectors until a public notice has been published for the area in which the claim is located.

The notice gives each claimant 150 days after the date of first publication to do one of three things. He may ignore the notice giving the government the right to manage and dispose of the vegetative surface resources or he may execute a waiver relinquishing all surface rights on his claim although this is usually done prior to publication of the notice.

He may also file a verified statement with the Bureau of Land Management asserting validity of his claim pre-dating passage of the law. If this is done, the claim will be examined by a qualified Forest Service mineral expert and if there is no question of the asserted surface right in a claim, a stipulation will be made so that he will be unaffected by the notice of determination of surface rights.

The present examination will be done mostly on foot through the forest lands at the head of Baggs Creek, Peterson Creek, Dry Cottonwood Creek, Girard Gulch, Brown's Gulch, and the head of the Boulder River above the mouth of Lowlands Creek. Any sign of prospecting, corner markers or claim notices will be carefully checked and the owners notified.

Favre Eaton, assistant supervisor of the forest, said the entire Deer Lodge Forest will be examined for unpatented claims in about five years. Areas in the Mount Powell section were examined last summer.

Continental Rare Metals Inc., Hamilton, was granted a charter to do business in Montana. The firm with authorized capitalization of $3,150,000.00 would explore for ores and minerals, and carry on the business of mining and milling.

NEVADA

Consolidated Coppermines Corp., which earlier this year sold its White Pine County, Nev., copper holdings to Kennecott Copper Corp. in an $8-million deal, has decided to withdraw entirely from the base metals field.

Thunderbird Development Corp. is processing 200 tons of tailings daily with a new type of concentrator recently installed at Millers, 14 miles west of Tonopah. The plant employs the pinch-sluice method, which is a new process in the Tonopah area. It has a capacity of 1,000 tpd, and was designed and made by the Thunderbird Corp. Additional units may be added if and when needed. Three men are employed at the site, processing tailings from the Tonopah mill, one of Nevada's "big ones" during the early years of the present century. The project is under direction of Sidney Cox, president.

Henkle Drilling Co., Long Beach, Calif., has completed the first phase of drilling and sampling operations on the Ione

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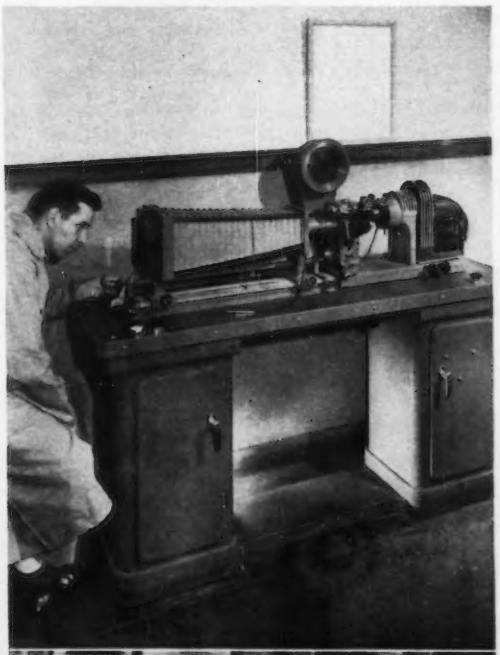

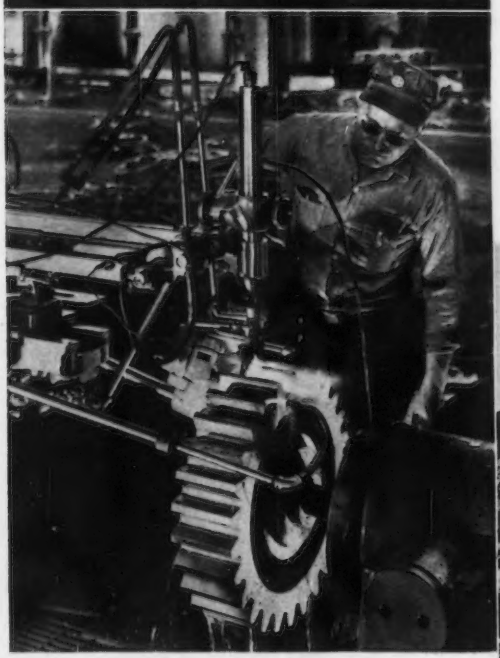

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In the Orinoco region of Venezuela, where this Bucyrus-Erie 190-B shovel is loading iron ore, dependability is vital. In remote areas especially there's no place for the "will fit expert".

Acari Moves Toward the Production Stage

HIGHLIGHTING the current development of the Acari (Minas de Hierro) iron ore deposits in Peru, was the recent dedication of the airplane landing strip, about five miles north of Bella Union. Acari's deposits, located about 320 miles south of Lima will be mined by open pit in the first stages.

Acari No. 1, the first orebody which is to be developed, contains high-grade iron ore exceeding 65% iron. The orebody has been blocked out by trenching at the top where the overburden is about 8 ft thick and by tunneling on the sides.

Project manager for the development is Norman S. McHarg, of Wells Overseas Ltd.

At the Port of San Juan, terminus of the heavy-duty highway over which the ore from the mine will be brought for shipment, Frederick Snare Corp., of New York, is now building the pier. Located in approximately the center of San Juan Bay, one kilometer north of the Marcona Mining Co. pier, it will have a length of 1800 ft and be 50 ft wide. The rock fill and approaches to the pier are now being built and pile driving will start shortly. In charge of the Frederick Snare operations is A. W. Hendricksen. Bulldozers are now clearing the area for access roads, stockpiling, and the conveyor belts that will carry the ore to the gantry crane on the pier for ship loading.

Completion of the pier and other port facilities is expected for mid-1959, at which time the heavy-duty highway will also be completed and Acari will then be in a position to start shipping ore at the rate of approximately 1-million tons a year, with volume to be increased gradually.

Nevada *(Continued)*

gold placer claims near Ione in Nye county. Under contract from Goldfield-Rand Mines Co., the firm drilled 22 holes and results showed free gold values in excess of 85c per yard, according to Les Warfield, field supervisor for the owners. An Anderson-Clark portable placer sampler was used to assay the drilling samples. Russ Kirsan, president of Goldfield-Rand, has announced that a large rotary drill has been contracted for and will be placed in operation at the site in the very near future.

Bristol Silver Mines Co. is making regular shipments of silver-lead-copper ore from its property near Pioche in Lincoln County. During 1957 the company spent $50,000 for machinery and capital additions, $21,000 for replacement and modernization of camp facilities, and $15,000 for repairs to the Snyder shaft, which caved on Oct. 3, 1957. After repairs to the shaft were completed exploration work resulted in discovery of a new and important orebody, from which production has been made ever since. Shipments are being made to the Salt Lake Valley smelters. Byron S. Hardie is general manager.

Hercules Mines Co., Austin, has purchased four claims in the Austin area from Carson Frazzini and Mrs. H. C. Cameron. The property adjoins the Apex mine property where Apex is producing large values in uranium ores. Hercules, a former uranium producer in Lander county, has also acquired the Laurent claims near the Apex property and ten other claims in the vicinity of the old Union mine. A diamond drill has been moved onto the newly acquired claims, and exploration is under way. Good values have been indicated by scintillation counter. Bulldozing operations have resulted in opening some promising ores on Hercules property also, according to company officials. The present activity is the first undertaken by Hercules in several months, during which the firm has remained dormant.

Core drilling at the gypsum property of Fibreboard Paper Products Corp. near Apex, has indicated reserves of 750-million tons, making it one of the largest deposits in the world, president William L. Keady reported.

The deposit will be economical to mine, requiring an investment at the site of less than $1-million. A beneficiation process has been developed and the mine will go into production within a year.

The company is planning to double the capacity of its Southgate, Calif., plant, where the gypsum will be converted to building products.

Nevada Cement Corp. has broken ground for construction of northern Nevada's first cement plant, which they plan to build near Mill City in Pershing County. Present for ground-breaking ceremonies were representatives of Gov. Charles H. Russell, and members of the Lovelock and Winnemucca Chambers of Commerce.

President of the firm is Robert J. Caron, vice president of U.S. Water Conditioning Corp., Bell Gardens, Calif. Vice president is N. G. Baxter, Fullerton, Calif., who is resident engineer in charge of the project. The company is capitalized at $3-million, and Baxter reported that the plant will cost more than $1-million. Extensive limestone deposits running up to 98% in calcium carbonate are available near the plant site, which lies close to Highway 40 and the Southern Pacific main line. Company plans call for construction of 15 houses and employment of 65 people by mid-1959. The plant will have a capacity of 500,000 barrels of cement annually.

White Caps Gold Mining Co. made an important gold find on their property in Manhattan, Nye County, during July. While doing assessment work on their April Fool claim a bulldozer cut through a five-foot vein showing an estimated value ranging from $35 to $500 per ton. A length of 50 ft has been uncovered, and further development work is proceeding.

Shipments of ore will go to the smelter at Selby, Calif. Officers of the firm are Carson Frazzini, president; Hugh Cameron, vice president; Walter Naismith, secretary-treasurer, and William Crowell, director and legal counsel. All live in Tonopah.

The White Caps mine at Manhattan has been operating under the direction of George Rong, and steady shipments of antimony-tin ore have been made during 1958. The April Fool claim, first ever filed in the Manhattan district, was purchased by White Caps Co. two years

TRIPP PIT, part of the White Pine County holdings acquired by Kennecott Copper Corp. in its $8.4-million purchase from Consolidated Coppermines Corp., will be closed down under an "assimilation of newly acquired properties" requiring a "revision of mining procedures", Kennecott announced.

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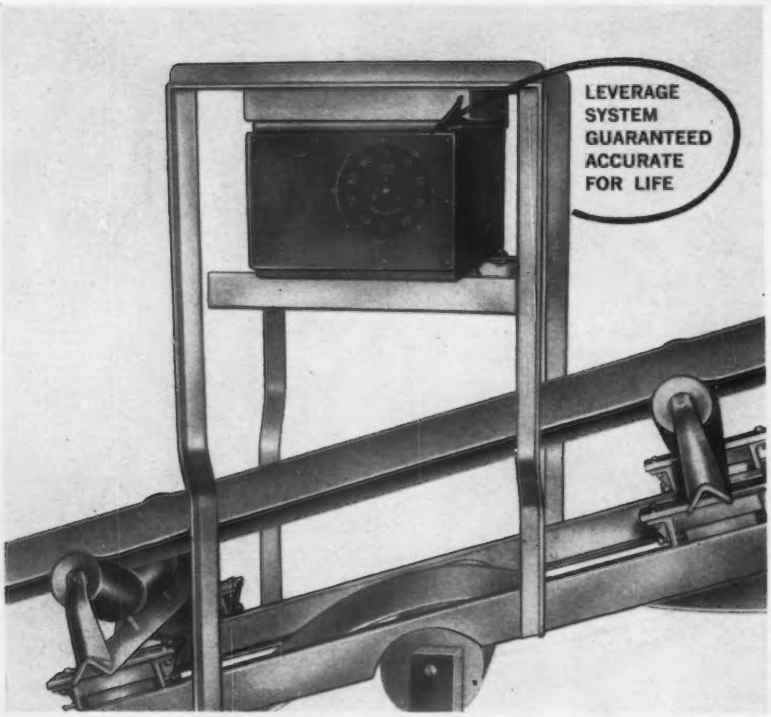

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A new type continuous inventory scale is being used for refractories, mining, fertilizer batching and other rugged operations where maintenance is usually a problem.

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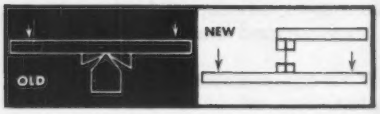

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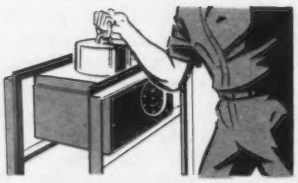

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Nevada (*Continued*)

ago from Charles Keough, a resident of Ione, Nev.

Although Manhattan produced $10-million worth of gold-silver ore from 1905 to 1948, the area where ore was found by White Caps had been thought to be barren. The strike is so near the old post office building that development will be difficult without moving the structure.

NORTH CAROLINA

A group of landowners in Beaufort County, have banded together into an organization known as Joint Venture and announced that test drilling would begin within a few weeks for the purpose of demonstrating the feasibility of commercial phosphate recovery in the area.

The group, formed to secure mining and sale of phosphate in the area, said it has employed as a consulting geologist Dr. Tom Gillingham, geologist specializing in phosphate and formerly associated with the Atomic Energy Commission and recently in charge of the Bear Creek Mining Co.'s phosphate program in Beaufort County.

Dr. Gillingham was quoted as saying that to the best of his knowledge and information, "no real effort has been made by anyone to really determine whether or not the mining of phosphate in Beaufort County is feasible." He said that main efforts thus far have been confined to attempting to determine the nature and extent of deposits and to secure land options.

The North Carolina State Board of Conservation and Development was told that a large quantity of phosphate in good quality exists in the Beaufort area near the Carteret County coastline and that it probably will be mined within the next 10 to 15 years. The report was made by Dr. J. L. Stuckey, state geologist and head of the C&D Department's Minerals Resources Division.

National Gypsum Co., Buffalo, N. Y., is acquiring property in Granville County, with a view of expanding operations, which is expected to spur early operations by the Carolina Pyrophyllite Co., which has holdings in the vicinity of Stem.

Carolina is a subsidiary of American Encaustic Tiling Co., New York, directors of which have approved a stock exchange deal under which National Gypsum would become owners of American Encaustic Tiling and its subsidiaries.

Grading changes being made by the General Services Administration as a result of conferences between North Carolina mica miners and Federal officials have been announced.

GSA has instructed mica inspectors and buyers at Spruce Pine, and elsewhere to disregard the samples recently provided for grading and to make a settlement for mica which had been accepted by the depot prior to the receipt of the samples; to withdraw samples so that they may be recon-

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N.C. (*Continued*)

sidered and pending reconsideration buyers and inspectors will buy mica under the standards in effect prior to the receipt of the samples; and to select an impartial panel, on which miners will be represented, to examine and reconsider the samples before they are finally put to use.

The miners protested use of the samples for grading because they contended they are not representative of the mica produced in western North Carolina. They contended that higher standard samples are needed to grade mica to be purchased in North Carolina than are needed for the purchase of imported mica.

The instructions to settle for mica accepted prior to the receipt of the samples will involve about 300 tons of mica at Spruce Pine. The settlements will be made "under the standards and grading procedures in effect before the samples were submitted."

PENNSYLVANIA

The Department of Mining at The Pennsylvania State University has been the recipient of a substantial equipment donation by the Joy Manufacturing Co. of Pittsburgh, Dr. Howard L. Hartman, head of the department, announced recently. Through the efforts of Mr. Hugo Nyquist, vice president of Joy and a graduate of the University, the company has provided the department with a powerful, variable-pitch mine fan valued at several thousand dollars for their ventilation laboratory.

The installation of the new fan is now complete. Dr. Hartman explained that this addition to their facilities enables the Department of Mining to conduct mine ventilation laboratory experiments and research that no other university in the country is equipped to do.

UTAH

Bear Creek Mining Co., domestic exploration subsidiary of Kennecott Copper Corp., has reportedly discovered what may be a substantial body of high silver value, lead-zinc ores at depth of 150 ft in prospecting in the East Tintic area of Utah.

Bear Creek, which has not made any announcement as matter of policy on the results of its underground exploration and surface drilling the last two years on the "Tintic Unit" did not disclose the assays.

However, the ore was reportedly discovered by drilling of core holes on the Apex ground controlled by an affiliate of Chief Consolidated Mining Co., Eureka, Utah.

The cores were wet, indicating a presence of water. A number of holes disclosed the existence of ore. The find was made in the footwall of great "North-South" fault in the Tintic area on which T. S. Levering of the U.S.

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Utah *(Continued)*

Bureau of Mines has done so much research.

It is reported that this fault creates a fissure system one mile wide in the Apex area, a fact which would indicate need for not only substantial additional exploration but possibilities of a widespread deposition of mineral values.

Bear Creek has completed its budgetary allotment for underground work (drifting and cross-cutting) for 1958. The firm is expected to continue with core drilling on the North-South fault.

Tintic Standard Mining Co. and others of the Tintic group of companies, Salt Lake City, is a participant with Chief Consolidated and Bear Creek in the unit-type exploration in the East Tintic District.

WASHINGTON

Daybreak Uranium, Inc., has completed a 37-hole exploratory drilling program at its mine on Mount Spokane, officials of the firm said. The company is now preparing a similar exploratory project for properties on the Spokane Indian reservation.

Officials said that 22 of the holes drilled showed mineralization, five of them indicated ore of shipping grade and 10 others had nearly commercial grade ore. The drilling was done to a depth of 96 to 180 ft. Officials said the mineralized zone is up to 460 ft long and about 25 ft wide.

Pacific Northwest Alloys announced plans to resume limited operations at its ferrochrome plant at Mead, in mid-August. The firm said that it plans to recall about 175 employees. The plant had been operating at less than capacity for nearly a year, and last month it had been shutdown completely except for a 25-man skeleton crew. At full capacity the company employs about 450 men.

The Spokane office of the Defense Minerals Exploration Administration has announced a contract with Uranium Corp. of America for an $85,000 exploration project at the Dailey copper mine in Jefferson county, Mont., located between Helena and Butte. Work was expected to start Sept. 1 and if the project reveals adequate mineralization of copper, silver, lead and zinc, it may become part of a larger exploration program, costing up to $244,000.

WYOMING

A bill passed by Congress to triple the acreage of public coal lands that can be leased by a single firm was hailed by Wyoming officials as a boon to the state's economy.

The bill would increase to 15,360 acres the maximum that could be leased. The maximum is now 5,120 acres. The bill has been sent to the President for his signature.

Wyoming Gov. Milward L. Simpson

CF&I Expansion Type Rock Bolt—with Pattin Type D-1 expansion shell . . . for 1⅜" holes . . . with right or left hand threads (to allow tightening by left-hand rotation of drilling machines). Also available, the Pattin D-5 shell for use with ¾" and ⅞" bolts in holes of 1⅜" diameter . . . and CF&I Slot-And-Wedge Type Rock Bolts.

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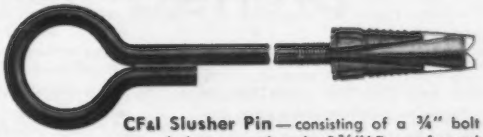
When you make your own slusher pins, the cost may be high and you may not get the best possible results. As a customer service, CF&I makes available Slusher Pins made to the same high standards of quality, performance and minimum cost as our Expansion Type Rock Bolts. Modified CF&I Rock Bolts also make excellent hangers for such equipment as air and water pipe, electrical cable, vent tubes and ventilating fans.



CF&I Slusher Pin—consisting of a ¾" bolt threaded at one end, and a 2¾" I.D. eye formed and welded on the other end. These are anchored in 1⅜" diameter holes by means of Pattin Type D-1 expansion shells, and successfully withstand the pull from slusher drums.

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George E. Gopher says:
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Wyoming *(Continued)*

said the measure could touch off "the greatest industrial development in Wyoming history."

Sen. Frank Barrett (R-Wyo.) has said the bill will pave the way for a $50-to $150-million synthetic fuels plant at Rock Springs and development of iron ore deposits near Cheyenne.

Union Pacific Coal Co. has said it plans to extract synthetic fuels and chemicals from coal and use the remaining char as fuel for a steam power plant if restrictions on use of coal from railroad rights-of-way are lifted.

The bill approved by Congress would enable Union Pacific or other coal companies to lease enough public coal lands to make such a synthetic fuel plant feasible.

Husky Oil Co. would market the liquid fuels produced by the Union Pacific plant. Under present regulations, Union Pacific's use of coal obtained from its rights-of-way is limited to locomotives.

Allen D. Gray, executive vice president of Fremont Minerals Corp., has asked the AEC office at Grand Junction, Colo., to consider establishment of a uranium concentrate sampling and shipping depot at Riverton.

He said such a depot would take uranium concentrate from the Lucky Mc and Western Nuclear mills in the Gas Hills area, Mines Development mill at Edgemont, S.D., and Fremont Minerals mill at Riverton.

Gray said the 4,500 tons of concentrate produced by these mills each year would warrant opening a depot separate from that at Grand Junction. Concentrate is now collected at Grand Junction. Gray said the present ore buying station at Riverton could be used. The AEC turned the station over to Fremont Minerals, but Gray said his firm would close the station as soon as its sampler is completed at the mill site.

Increasing sales of soda ash by Intermountain Chemical Co. has resulted in the recall of about 25 employees laid off several months ago, according to N. E. McDougal, resident manager.

Layoff was made, when sales of soda ash slumped, at the world's largest mine and mill producing natural soda ash from Trona. McDougal said a full complement of 400 employees is now working at the plant and mine 20 miles west of Green River. Freight shipments and sales are up to the level of a year ago, he said.

IN CANADA

BRITISH COLUMBIA

Engineering studies in B.C.'s Rocky Mountain Trench have yielded "even more than we expected," Axel Wenner-Gren reported in Vancouver.

Wenner-Gren B.C. Development Company has planned a vast hydrometallurgical project which would have

the profit you left behind

There it lays in the dirt. Your machines and equipment ground off in the grit, pounded off in the rock and ore. You can almost see the wear that shut down your machines too soon . . . idled your men too long . . . bled your profits too much.

Is there *one* material, *one* metal that can stop this excess wear waste?

One? It takes many alloys, engineered alloys (some you may never have heard of). It takes a list of Amsco® Alloys to span the entire range of wear applications.

Amsco Alloys that can work a full shift where severe abrasion knocked out toughest metals in three hours. Amsco Alloys that can belt rock and ore all day, and work tomorrow, too. Amsco Alloys that can work any abrasion-impact combinations you face and still resist the wear, stop the waste . . . save the profit!

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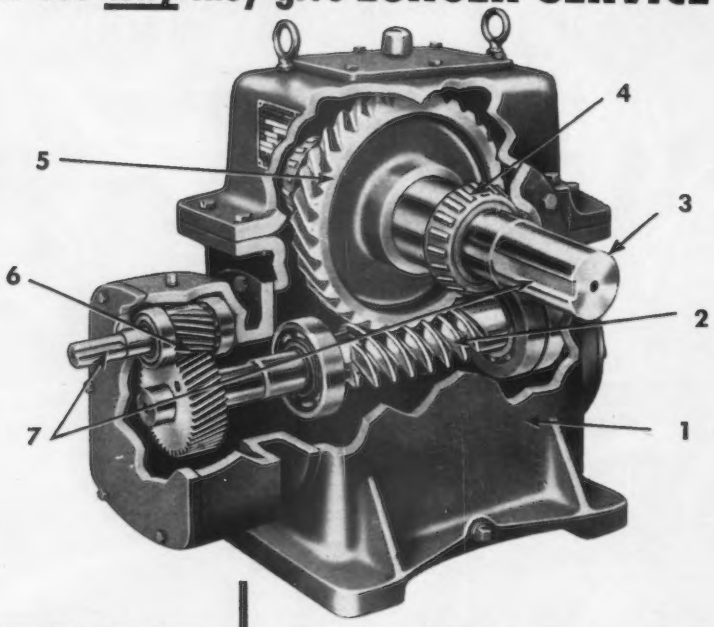

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B.C. (*Continued*)

as its objective a huge, integrated industrial area, including the world's largest single hydroelectric power installation, a railway or monorail into the Trench, mines, pulp and paper-mill and associated industries. The power phase is the major key to the whole project. Engineers estimate that the region has a 3-million kw potential.

While the company will not commit itself, there are growing indications that the power phase is rapidly proving up.

Wenner-Gren was emphatic that financing the project presented no problems . . . "so many people from Europe and other parts of the world want to invest in it."

Bralorne Mines Ltd. reports 36,261 dry tons milled and 23,572 oz gold recovered for the second quarter of 1958, making a total of 72,740 dry tons milled and 47,474 oz gold recovered for the first six months of the year. The Queen shaft was extended 145 ft to a point five feet below the 36 level. Excavation for the 35 level pocket was completed and cutting of the 36 level station started.

Cellador Mines Ltd. reports about 1,000 ft of diamond drilling will be done on four old copper properties on Shawinigan Lake; the King Solomon, Queen of Sheba, Bluebell and Wallace mines. The company hopes to locate development ore which could be hauled to the Cowichan Copper mill at Cowichan.

Bulolo Gold Dredging Ltd. ceased operation of one or two dredges this year and production of gold for the three months ending Feb. 28 was $112,315 compared with $474,775 in the previous year.

Cassiar Asbestos expects gross sales to exceed $9-million compared with $8.3-million in 1957.

The company, which holds three asbestos prospects under option from Conwest Exploration, has not yet been affected by the cutback in the asbestos industry which has slowed down sales generally.

Ore reserves which were set at 9-million tons last year will be increased this year. On the Cirque Valley side, a new adit has been collared and if it opens the orebody as anticipated, ore reserves will be doubled.

Stream gravels in an undisclosed location in B.C. have yielded seven or eight minute diamonds to prospector Carl Stevenson who staked the claims for Royal Canadian Ventures Ltd.

The company has retained the services of a consulting engineer to collaborate with Stevenson.

Samples were said to contain minute diamonds of the order of 10 milligrams, (one around .3 carats).

New Hamil Silver-Lead Mines report the magnetometer survey on the Highland Valley property as showing a sixth anomaly.

An exploratory program has been recommended which calls for diamond drilling of anomaly No. 1, and exploration of anomalies 2, 3 and 4 after

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IN A SEA of feldspar, bulldozer at Camden, N. J. stacks part of a 4,000 ton shipment of concentrate, produced by an electrostatic process by Spar-Mica Corp., Ltd., of Montreal. Spar is mined at Cape Feldspar, on the north shore of the St. Lawrence River. Material is processed to granular size at 0.05 FeO.

B.C. (*Continued*)

completion of diamond drilling on 1. The anomalies range from 400 to 2,000 ft long and from 100 to 600 ft wide.

Assay results from the exploration and development program at Canadian Radium Corp. Ltd. Horn silver mine in B.C.'s Similkameen valley show results as high as $402.15 per ton in gold and silver. Drilling is being changed to a larger size core. Simultaneously, high grade ore is being stockpiled for shipment to the Tacoma smelter.

Although a net profit for the year of $242,198 (a gain of $5,886 on last year) was reported by Pioneer Gold Mines of B.C. Ltd., ore reserves are stated to be dwindling and an "accelerated exploration program" has been launched.

A substantial sum of money has been allotted for an accelerated exploration program at the company's Bridge River mine in an effort to find new ore reserves.

Bethsaida Copper Mines Ltd. will await further development on the nearby Craigmont and Noranda groups and thus delay more detailed survey on its Highland Valley property. Line-cutting, prospecting and reconnaissance geological and magnetic surveys have been carried out on the 26 claims. Investigation of a number of prospects is under way.

Diamond drilling will begin in August on the Highland Valley property of Beaver Lodge Uranium Mines Ltd. following a geophysical examination.

The company is making arrangements with Northwestern Explorations Ltd. (subsidiary of Kennecott) which is doing the work under a 60-40 agreement, to examine the company's Outrider group of claims which adjoin Bethlehem property.

Consolidated Mining & Smelting Co. has announced that an agreement has been reached with Conwest Exploration Co. of Toronto whereby Consolidated undertakes to explore Conwest's N'kana group adjoining the Con-Rycon property near Yellowknife, NWT.

Cominco will spend $250,000 in underground exploration on the property. If the property is brought into production, Cominco may then obtain a two-thirds interest in a new company incorporated to take over the property.

Shareholders of Craigmont Mines, at an extraordinary general meeting approved an agreement with Canadian Exploration, Noranda and Peerless Gas & Oil. The latter three, as operators, will spend between $500,000 and $1-million within three years in exploration of Craigmont's Highland Valley property, earning a 60% interest.

New Delhi Mines has started a program of geological mapping and surface prospecting on its two groups in the Craigmont area. The company also is proceeding with exploration of its nickel holdings in Oregon.

Results of geophysical surveys of Tarbutt Mines Ltd. claims in the Craigmont area of B.C. are "not encouraging" according to Franc R. Joubin and Associates, mining geologists.

Rio Tinto Canadian Exploration optioned the claims and arranged airborne surveys. One area of magnetic anomalies was investigated from the ground and proved to be sparsely disseminated magnetite in granite.

New Santiago Mines Ltd. has received gratifying assays of five samples of ore from the Bosun silver-lead-zinc mine at New Denver.

The first three are representative of the band of galena which measures from 6 to 10 in. on the hanging wall in a drift being driven on a sublevel from a winze below the No. 6 level and beyond the farthest extension of the mine's No. 7 level. The pre-bearing material extends to an average width of two feet.

Magnum Copper Ltd., a new company which controls 64 claims with visible copper near the Alaska Highway, will start a $100,000 drilling program.

Dr. Chris Riley, consultant, reports that the ore bearing possibilities are "great enough to warrant the expenditure of considerable sums on early development."

He made a guess at tonnage and grade suggesting the possibility of 1,500 tons per foot of depth with the chance of a 5% copper.

Fort Reliance Minerals has obtained an option on a copper prospect on the Toad River in northeast B.C. and has staked 16 additional claims. Sufficient work will be done on the company's various properties to maintain them in good standing this year.

ONTARIO

In his recent address at the annual meeting of stockholders of the Rio Tinto Mining Co. of Canada Ltd., outlining some encouraging aspects of Canada's mining future, president Robert H. Winters said that arrangements have been made "to supply the United Kingdom with an additional quantity of uranium with an approximate value of $105-million between 1962 and 1963, and . . ." that negotiations were continuing "for the supply of a substantial part of Britain's uranium needs between 1963 and 1966.

"In addition, bilateral agreements with Germany and Switzerland pave the way for the sale of natural uranium to those countries."

Production rate at the gold producing property of Madsen Red Lake has reached the highest level since operations began 20 years ago. Second quarter output at the Red Lake area mine established an all-time quarterly record of $1,210,636 from 7,745 tons milled, an average recovery of $15.99 per ton. The major project of enlarging the shaft to five compartments, started in 1955, is just about completed. Shaft deepening for 1,000 ft to the 3,950-ft depth is making good progress with two new stations cut.

Gold production at Macassa Mines in the Kirkland Lake area is running slightly above last year. In the first six months of this year, output was valued at $1,259,240 from 83,303 tons milled, compared with $1,155,024 from 68,706 tons treated in the corresponding period last year. Mill rate was 460 tpd against 400 tons in the 1957 period. Ore reserves at June 30, 1958, were estimated at 895,265 tons grading 0.453 oz gold per ton, down slightly from year end 1957.

Fatima Mining Co. has resumed diamond drilling at its nickel prospect south of Timmins. Geochemical work is also being carried out over the peridotite plug

Biting through 22 ft of Abrasive Limestone

This drilling rig, equipped with Bethlehem Hollow Drill Steel, is putting down 3½-in. diam blast holes as deep as 18 ft in a quarry at Bowmansville, N. Y., operated by Buffalo Crushed Stone Corp., a unit of Houdaille Industries, Inc. The limestone, for use in construction projects, is being drilled economically with 2-in. round Bethlehem Hollow, fitted with carbide-insert bits. Reconditioning is done by Niagara Bit and Drill Steel Corp., North Tonawanda, N.Y.

Any type of rock drilling, regardless of the type of formation, can be drilled with minimum breakage when you use Bethlehem Hollow. This is because it's rolled from a special fatigue-resistant steel. It has a uniformly round hole, centrally located in the bar, and a wide quenching range. It can be heat-treated easily for the proper balance of toughness and wear-resistance. The result: durable threads and shanks.

Bethlehem Hollow comes in Carbon and Ultra-Alloy grades in rounds, hexagons, and quarter-octagons. Standard lengths range from 18 to 27 ft. Longer lengths can also be supplied. Specify Bethlehem Hollow for your next rock drilling project.

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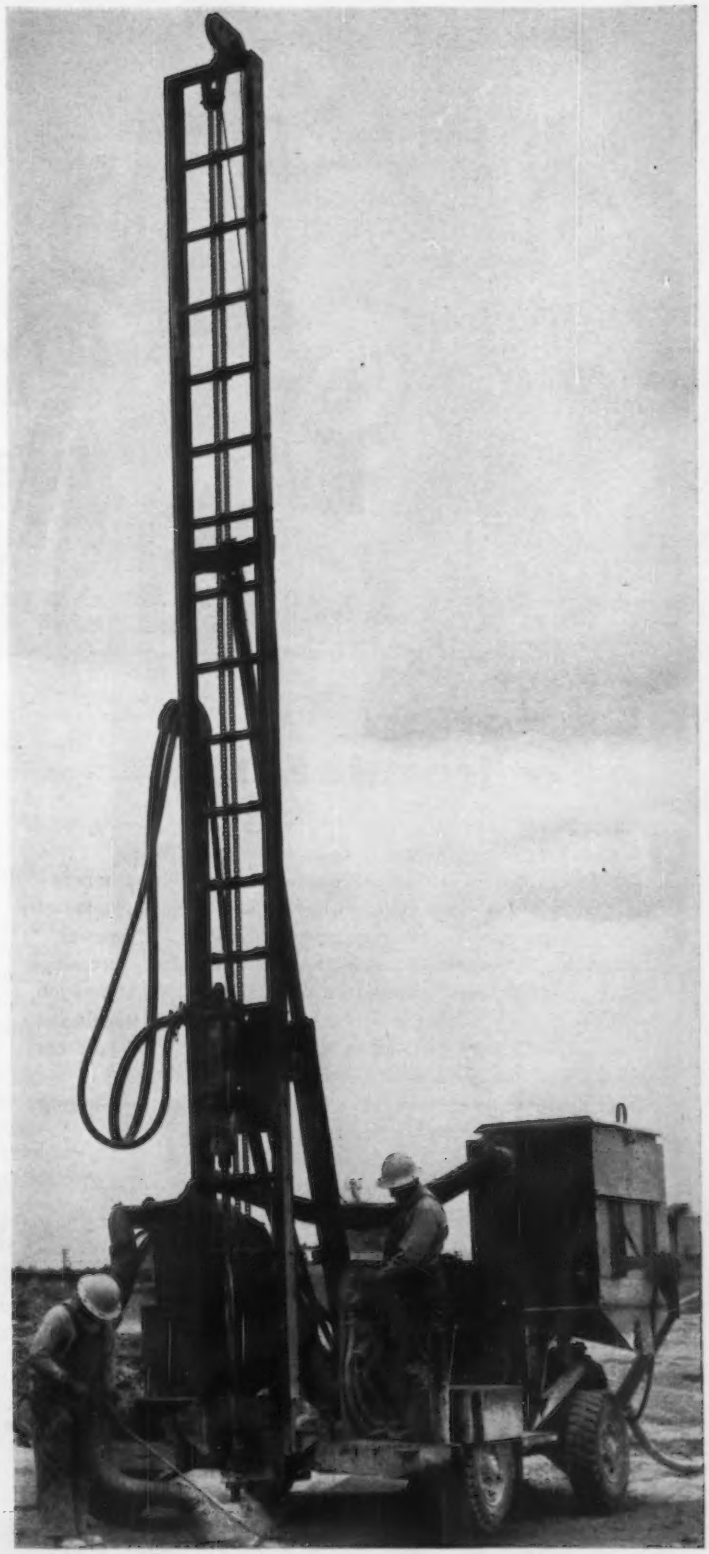

Drilling rig, equipped with Bethlehem Hollow Drill Steel, making blast holes at limestone quarry of Buffalo Crushed Stone Corp., Bowmansville, N. Y.

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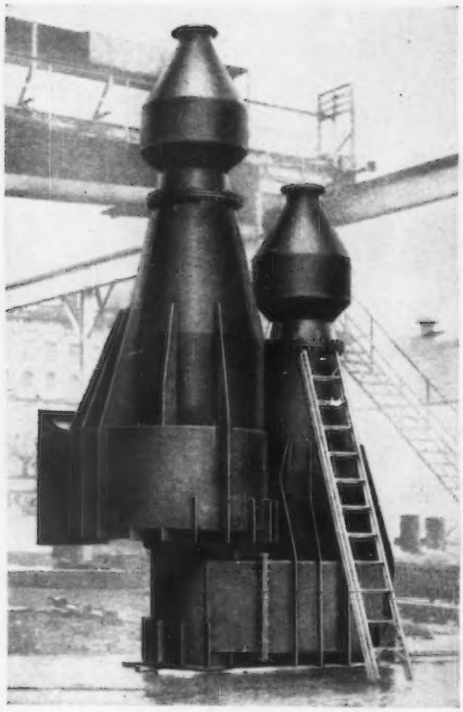

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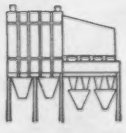

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Ontario *(Continued)*

which extends for a length of 7,000 ft and a width of 1,000 ft.

Canadian Charleson is continuing tune-up operations at its iron property in the Steep Rock area. The plant initially is treating 450 tons of gravel per hour on a one shift basis with ore being stockpiled. A 1½-mile rail spur, being constructed to link up with the Steep Rock line, is expected to be completed this year. Operations at the property will be on a seasonal basis. Rated plant capacity is 250,000 tons iron ore per year which requires treatment of some 2-million tons of hematite-bearing gravel annually.

Faraday Uranium Mines is embarking on a shaft deepening program at its uranium producing property in the Bancroft area. Shaft is being dropped 560 ft to 1423-ft depth to provide four more levels from the present 600-ft level. Development work is showing consistently better grade than mine average on the bottom, or 600-ft level. Drilling from the level has also indicated additional ore shoots in the area.

An agreement has been concluded between Craibbe-Fletcher Gold Mines and Campbell Red Lake Mines whereby the latter will carry out underground exploration on the adjoining Craibbe property. A drive is to be extended from the Campbell 2,050-ft level along the western extension of Campbell's rich F zone. The Craibbe boundary lies about 2900 ft from the present heading on that level. The properties are located in the Red Lake camp.

A shaft deepening program is being started at the Red Lake area gold property of New Dickenson Mines. Four new levels are to be established to depth of 2,970 ft. Production continues an upward trend with output for the first half of the current year at an all-time high of $1,443,942. Extensive drilling below the bottom level has indicated a possible pair of new ore structures. These are in addition to the F zone located on the bottom level some months ago.

Willroy Mines is moving its mill rate up to 1,000 tpd at the zinc-copper producing property in the Manitouwadge area. Shaft deepening is scheduled to get under way to open three levels below the present bottom level at 800 ft. In exploration work, a drive is going out on the 650-ft level and will be carried to the Geco boundary. A thorough drill program is to be undertaken from this heading.

Diamond drilling is being carried out on the Gogama area property of Three Duck Lakes Syndicate to test a series of electromagnetic anomalies. The syndicate is owned jointly by Area Mines, Leitch Gold Mines and Marchant Mining Co. Seven of the 13 anomalies outlined are to be tested. Base metal mineralization was indicated on three of these in geochemical work. Several staking parties moved into the area following news of the geophysical survey

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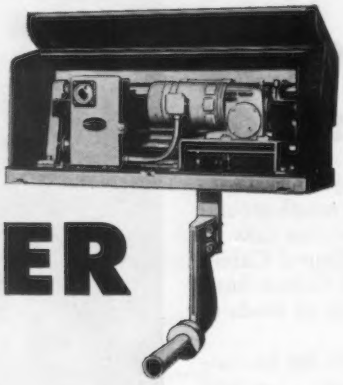

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Ontario (*Continued*)

results and it is expected that several companies will be active in exploration in the area this season.

A promising copper deposit has been outlined in diamond drilling by Cyprus Exploration on a property about 55 miles northeast of Sherbrooke in the Eastern Townships. An estimated tonnage potential of 2,700 tons per vertical foot has been calculated from results of 15 holes to test a geophysical anomaly. Grade is given as 2.25% copper, 3.92% zinc, 1.21 oz silver and 0.016 oz gold per ton. Average width of the structure is 24 ft with drill-indicated length of 900 ft. The deepest hole at 500-ft depth showed no change in the structure. The property was acquired under working option from Hastings Mining and Development Co. Additional ground has been staked adjoining the discovery group.

Steep Rock Iron Mines, Ltd. started up its new south concentration plant at the Errington mine in July. The plant contains scrubbers, a heavy-media section, jigs and spirals. It will treat ores from the Errington stock-pile and underground production. The north concentrator, at the Hogarth mine, is expected to be completed in August, but may not be used this year.

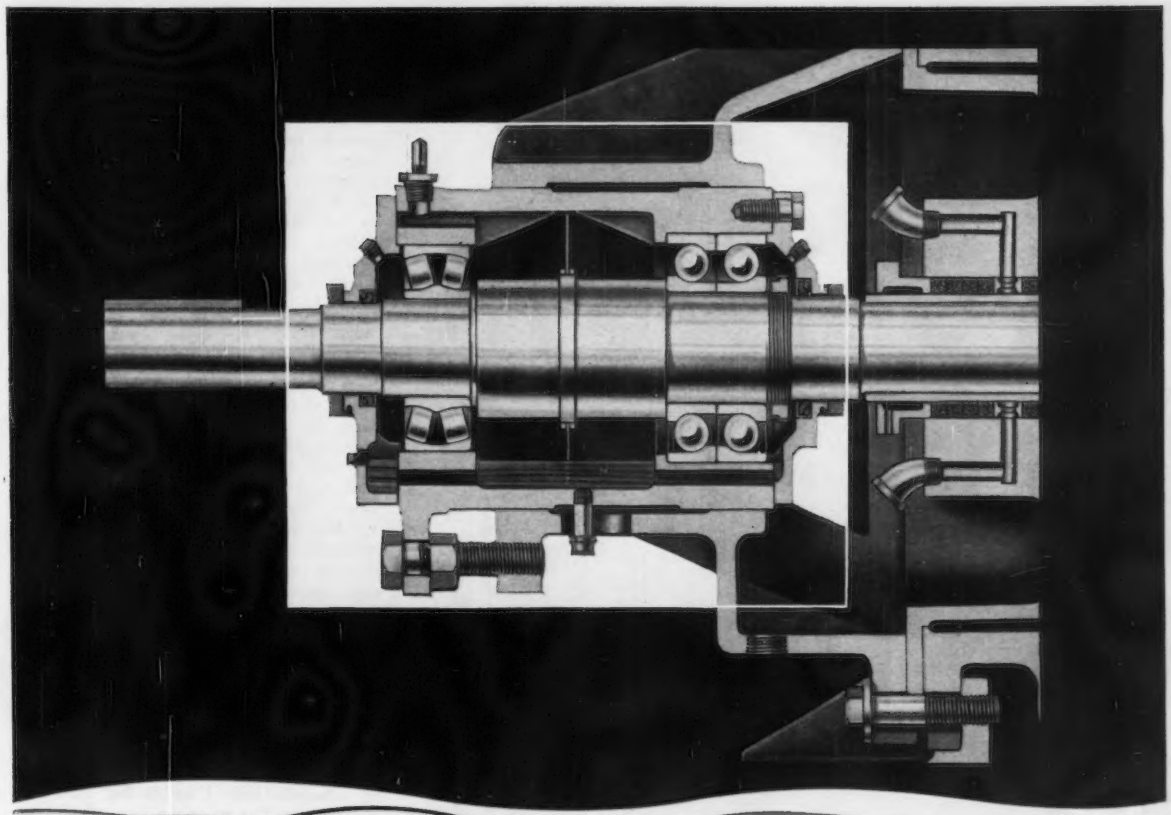
Present schedule calls for iron ore production from Caland Ore Co.'s (Inland Steel Co.) lease of Steep Rock's "C" orebody in the spring of 1959, earlier than originally expected.

QUEBEC

Continued diamond drilling has added substantially to the ore picture at the Barnat Mines' gold producing property in the Malartic area. The new orebody has now been indicated to have a length of at least 600 ft with width of from 200 to 300 ft and vertical extent of some 400 ft. Further drilling is in progress to detail the orebody further. Tonnage has been estimated at from 12,000 to 15,000 tons per vertical foot on the 900-ft level.

Developments at Barnat has sparked new exploration in the Malartic area. Among newcomers to the scene, Tib Exploration has started work on a recently acquired 610-acre property adjoining Barnat on the north. Porcupine Prime has picked up 14 claims adjoining to the west. Britt-Malartic with property adjoining to the northeast is considering a diamond drill program. East Amphi is also planning work for its group adjoining on the north.

Diamond drilling is planned by D'Aragon Mines on its property in Lozeau Twp. in the Mattagami area. Several copper showings have been located along a length of 5,000 ft in a valley stretching some 10,000 ft across the property. Additional claims have been staked and a geophysical survey is being carried out on the new claims. The company is also active on a group in Daniel Twp., about



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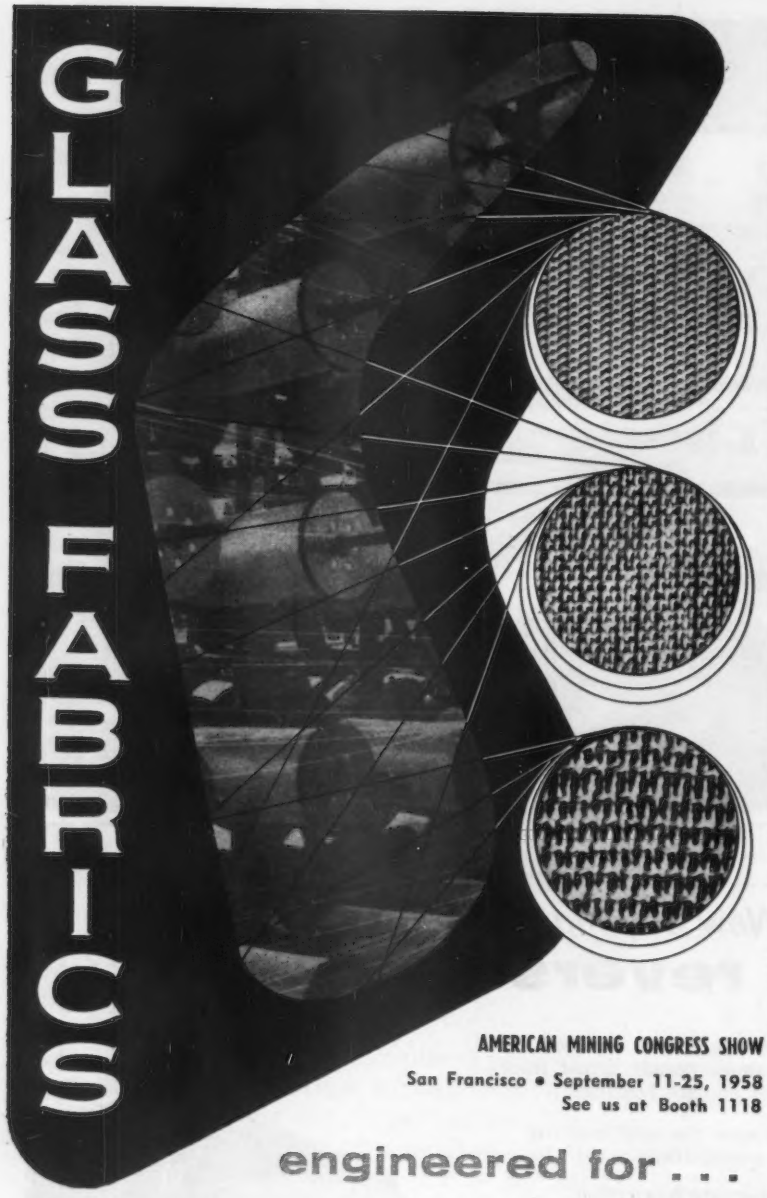

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Quebec (*Continued*)

six mlies northwest of the New Hosco property.

Kennco Explorations (Canada) is reported to have made an interesting copper discovery on one of its several properties in the Mattagami area. The group is understood to be located east of Bell River about seven miles northeast of the Mattagami Syndicate property and 12 miles east of New Hosco. Copper mineralization is said to have been obtained in three or four holes and drilling is being continued.

Sullivan Consolidated Mines is getting back into production after a 2-year shutdown at its gold mine in the Val d'Or area. Preliminary mining was started mid-August with objective of bringing the mill back to its 500 tpd capacity rate as soon as possible. Last year the No. 1 shaft was deepened from the 1,275-ft horizon to present depth of below 3200 ft. A total of 13 new level stations was cut and connection was made on the bottom level with the No. 2 incline shaft. This will facilitate ore handling and hoisting facilities and will provide adequate shaft capacity to support a possible increase in milling rate.

Three new asbestos producers have been brought into production in the Eastern Townships this summer. Lake Asbestos of Quebec reached production or schedule July 1 at its big mine at Black Lake. The company is a subsidiary of American Smelting and Refining Co. and was formed to bring the Black Lake property of United Asbestos Corp. into production. In the Thetford Mines area, National Asbestos Mines, a subsidiary of National Gypsum Co. of Buffalo, N.Y., started operation of its 3,000 tpd mill in mid-July. Some 20 miles northeast of Thetford Mines, Carey-Canadian commenced tune-up of its 2,000 tpd capacity mill late in July.

Atlin Ruffner Mines (B.C.) Ltd. says it has granted a working option and lease on its iron property in Montgolfier and Orvilliers townships, Quebec, to Oglebay Norton Co., of Cleveland.

Under the arrangement, Oglebay Norton has 18 months to inspect the property, carry out metallurgical testing, etc., with first payment to Atlin of $50,000 due by Dec. 1, 1959. On completion of this payment, Oglebay will have an option to purchase 100,000 treasury shares of Atlin at 25c a share exercisable until Jan. 15, 1960.

In the recent Atlin annual report, F. H. Jowsey, president, said that there were over 1.5 billion tons of available open pit ore to a depth of 500 ft on the property.

IN AFRICA

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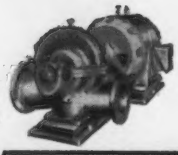

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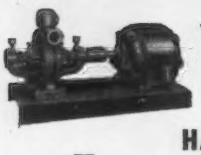

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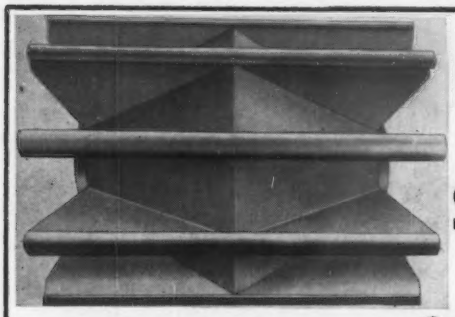

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Africa (*Continued*)

firmed former indications that on the eastern side of the property there is an upthrown block of reef-bearing ground. St. Helena is one of the Union Corp. group. Official announcements said that considerations were being given to the exploitation of this area which will require the sinking of a further shaft.

The sinking of No. 2 Shaft at Winkelhaak—one of Union Corp.'s Eastern Transvaal mines—has been deferred, the company announced. Owing to water-bearing fissures, operations in the No. 1 shaft area have not progressed as rapidly as in the No. 3 Shaft area. It has, therefore, been decided to sink a small parallel shaft, No. 3B, about 50 ft north of No. 3 shaft to increase the hoisting capacity in that area. The smaller shaft will handle men and materials so that the No. 3 can be used exclusively for rock hoisting.

Despite 1-million fewer tons being milled this year by the gold-mining industry, the total production of gold increased from 8,373,181 oz in the first half of 1957 to 8,565,518 oz for the comparable period of this year. Average yield per ton milled rose from 4.899 dwt a ton in 1957 to 5.162 for this year.

The average working costs per ton milled rose about 16c but the cost per ounce is 35c less than in the first half of 1957.

Uranium oxide production rose to 6,096,-539 lb from all South African sources during the first half of the current year, as compared with a production of 5,449,-315 lb for the same period last year. The average yield has improved from 0.513 lb a ton to 0.516 lb for the first six months of this year.

At the West Driefontein mine on the Far West and, where all the footage sampled remains payable, the gold values rose in the June quarter from 670 in.-dwt to 854 in.-dwt, the highest since December 1956.

Uranium values rose from 7.7 in.-lb to 13.5 in.-lb, the highest ever reported by the mine.

Extremely poor development values were recorded at Doornfontein, one of the Far West Rand mines, for the June 1958 quarter.

The footage payable has fallen from 91.8% to 86.9%. The gold values have dropped from 422 in.-dwt to 385 in.-dwt, the lowest for two years.

Uranium values recorded by the mine dropped from 9.1 in.-lb to 7.5 in.-lb for the June quarter. This is the lowest ever reported at Doornfontein.

Outstanding features of the June quarterly reports of the General Mining group of companies are the marked rise in the ore reserve values at Buffelsfontein, the sharp deterioration in the footage payable at South Roodepoort, and the recovery in development values at Stilfontein, on the Klerksdorp gold field. Fully developed ore reserves at Buffelsfontein have risen from 1,157,000 tons of 443 in.-dwt and 34.46 in.-lb a year back to 2,217,000 tons of 553

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Africa (*Continued*)

in.-dwt and 34.35 in.-lb at the end of June.

At South Roodepoort (West Rand), the footage payable has dropped from 35% in March to 15.7% over the last quarter—the lowest for several years.

Gold values at Stilfontein, which were 370 in.-dwt in March, rose to 456 in.-dwt during the last quarter.

The Anglo-Transvaal group June quarterly reports show that gold values from development at Hartebeestfontein recovered from their near record low point of 404 in.-dwt in the March quarter to 433 in.-dwt. This figure, however, is still substantially below the average for the mine. It compares unfavorably with the September 1957 figure of 488 in.-dwt.

The seasonal decline in the monthly gold output from South African mines during June of this year was smaller than in June of 1957.

The total output by all producers amounted to 1,447,571 oz. This was 24,883 oz less than in May and was valued at over $50,500,000.

The June figure compares favorably with the output during the comparable month of last year, which was 1,420,021 oz.

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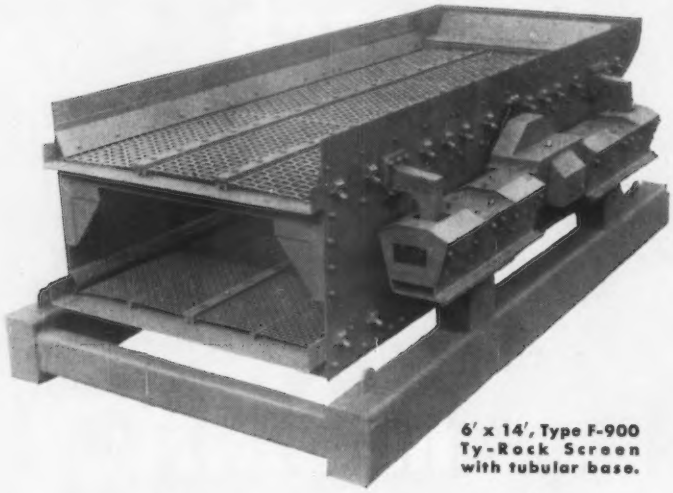

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An official of the Anglo-Transvaal Co. has reported that the water level in a chain of mines in the Free State goldfields is dropping by about 30 ft per month. A vast pumping drive at certain points is lowering the water level in shafts where there is no pumping.

The Virginia Mine, with the use of 16 huge electric pumps, is drawing 8-million gallons to the surface daily.

In spite of voluntary cutbacks to assist the world price of copper, Northern Rhodesia's Copperbelt mines produced at a much higher rate during the first quarter of this year than in the comparable period of 1957.

The output of blister copper for the quarter increased from 39,312 tons to 45,491 tons. Electrolytic copper production improved from 64,652 tons to 69,358 tons.

A comparison of values, however, reflects the price fall at the end of last year and the beginning of 1958. The combined values of both products dropped from about $70,840,000 to just over $52,158,000.

The $3.5-million scheme for producing titanium in the Eastern Cape Province has been shelved as a result of the fall in the world price of the material. It was recently announced that a U. K.-Australian corporation was to operate on four titanium areas offered it by interests in Port Elizabeth.

As a result of a research program at the Kansanshi mine on the Rhodesian copperbelt, methods have been outlined for the recovery of 90% of the copper treated in a mixture of concentrates derived from sulphide and oxide ore balanced to known reserve grades and tonnages. If the experiment encourages further development, a program of continuous pilot operations will be required to determine capital and operational costs.

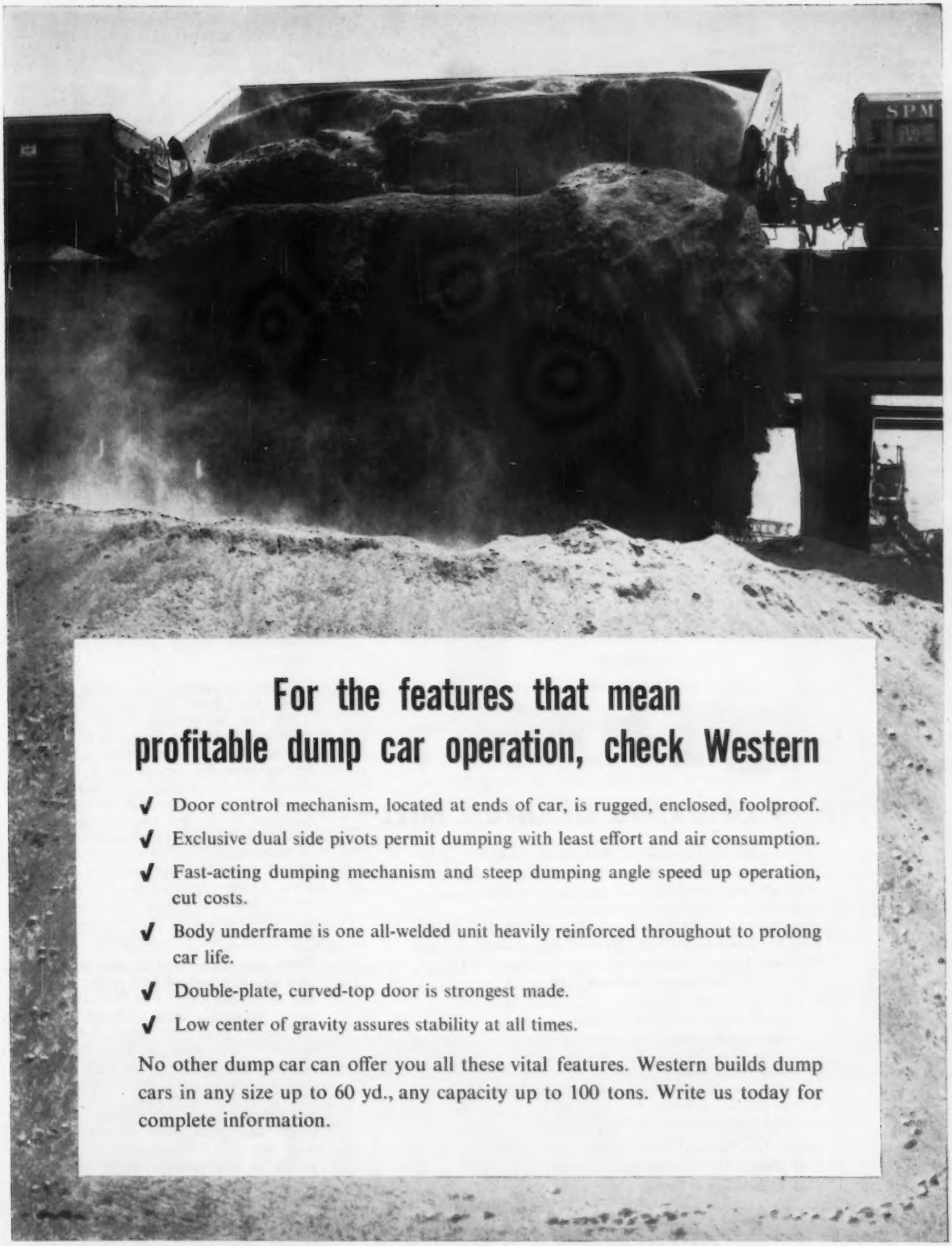
Deposits of pyrochlore-bearing limestone in the Feira area of the Zambesi valley in Northern Rhodesia may prove to be the largest in Africa, if not in the world, according to a report by the Northern Rhodesian Government Survey department. The extent and quality of the deposits are under examination by the Northern Rhodesian Government.

The South African gold mining industry, with an output of 1,499,237 oz during July, smashed all records for a single month's production.

According to the Transvaal and Orange Free State Chamber of Mines, the previous peak of 1,479,439 oz (reached in July of last year), was exceeded by nearly 20,000 oz. It was well above the previous high for this year—1,472,454 oz produced in May.

July's production value ($52,473,300) was also a record and was nearly $644,400 higher than the single month's record set last year.

During the quarter ended June 30, 31,793 long tons of manganese were produced and 20,484 tons were shipped out of the Union, according to a report issued by S. A. Minerals Corp. Produc-



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Africa *(Continued)*

tion exceeded the previous quarter's figures by 4,000 tons, and was double that of the comparable period of last year. No chrome was produced during the quarter and only 998 tons were shipped. In the report of the previous quarter, it was stated that the operations at the chrome mine were suspended on March 15.

An aerial search for uranium deposits in Kenya will be made by the U.K. Atomic Energy authority in conjunction with Hunting (Geophysics) Ltd. According to a reliable source, the radiometric aerial survey is planned to cover 4,000 square miles of the coast and inland to Mackinnon Road.

According to the annual report of the Selection Trust Co., Bikita Minerals in Southern Rhodesia has developed a substantial tonnage of low-grade beryllium. Considerable research has been done to determine a satisfactory method of concentration. Pending an improvement in the market, however, no decision has been taken on the installation of concentrating facilities.

With the exception of lithium ore and, to a minor extent, coal and tungsten/scheelite concentrates, the output of the principal minerals of Southern Rhodesia for the period January-April 1958 exceeded production in the same period last year. Chrome ore registered the biggest advance (from almost 188,000 tons to nearly 220,000 tons) while tin jumped from 52 tons last year to 207 tons in 1958.

The amount of Union-produced manganese carried by the South African Railways to ports of shipment for export is dropping. The amount trucked between April 1957 and Feb. 28, 1958 dropped by nearly 54,000 tons as compared with the corresponding period of 1956/1957. Iron ore also fell sharply over the 10-month period, declining from a previous total of 9,086 tons to 4,770 tons. Chrome carried for export showed just the reverse—increasing from 609,722 tons to 640,170 tons.

The railways have been generously provided for in the Union's budget with a view to stepping up its carrying capacity.

Amosite asbestos, produced from the mines of the Cape Asbestos Co., Ltd., will be used in insulating the nuclear power station now being built at Berkeley, England. Cape Asbestos will carry out the entire insulation work at this station, involving the 280 ft high reactor vessels, 16 heat exchangers and other equipment. This will be done in "Caposite" moulded amosite asbestos insulation and "Rocksil" rock wool insulation.

Uranium production in South Africa could rise from last year's figure of 5,709 tons to between 7,000 tons and 8,000 tons by 1963, according to reliable sources. The 1957 production is believed to represent the biggest output by any country in the world. This estimate is given by the "Overseas Review" of Barclays Bank. But the average grade of South African uranium-bearing ore is lower than that of Canada and the United States, the journal says. However, the regularity of the Union's orebodies, together with an enormous long-term potential, give the industry in this country considerable stability.

There are indications of the existence of a new mineralized field in the Wankie and Sebungwe districts of Southern Rhodesia, according to a geologist of the territory's Division of Mines, Lands and Surveys. Economics deposits of radioactive minerals might reasonably be expected in these districts, the report adds.

Lead-copper-zinc concentrates (20,993 tons) and manganese (11,942 tons) were the only base minerals to be produced in any quantity in South West Africa during May of this year. The production of tin ore concentrates added up to 2 tons and tin-wolfram totalled 13 tons.

Electrolytic copper production in the Copperbelt during March surpassed the output for March 1957 by about 2,200 tons. The figures were: 24,694 tons in March 1958; 22,458 tons for March 1957. Zinc, lead and manganese ore

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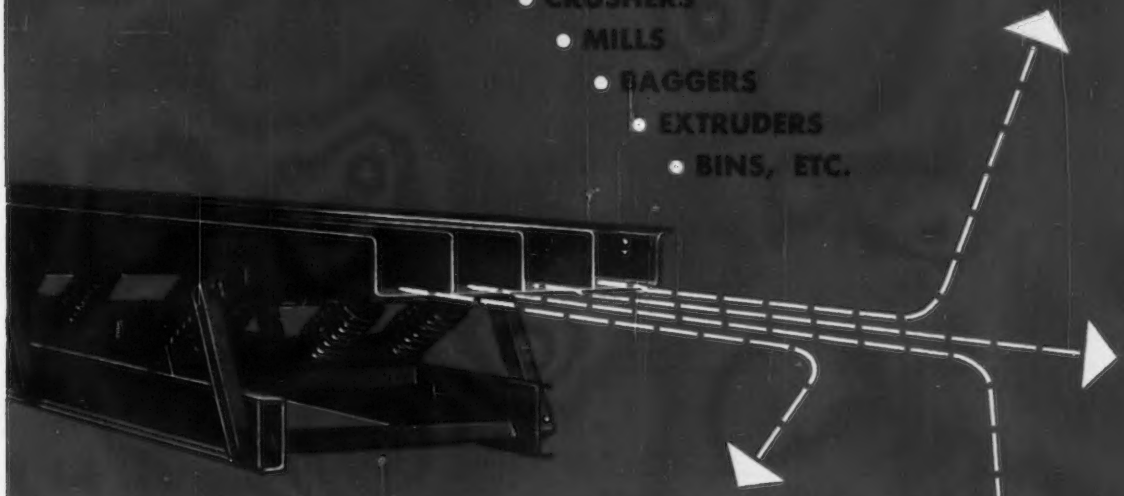

● **Low Headroom, Distant Delivery**—One Carrier Conveyor with a single drive and less than 30 inches of headroom distributes materials to a line of receiving equipment up to 500 feet long! Capacities up to 500 TPH.

● **Gentle Conveying**—Carrier's patented Natural-Frequency conveying motion (gentle "throws and catches") distributes even the most fragile products with no particle breakdown!

● **No Spillage or Contamination**—Smooth, one-piece troughs prevent spillage, hang-up, and contamination! Separate channels prevent intermixing. Dust covers and flexible connections can also provide completely dust-free, sanitary operation.

● **Increase Process Efficiency**—Vibration automatically levels materials in trough, resulting in even feeding across full width of screens, crushers, etc.

● **Dynamic Balancing**—Special design eliminates harmful vibrations—even in upper-floors of very light structures.

● **Low Maintenance**—Low input horsepower, few moving parts, and low drive stresses assure absolute minimum maintenance and downtime!

CARRIER NATURAL-FREQUENCY CONVEYORS

Carrier Conveyor Corporation
213-A North Jackson Street
Louisville 3, Kentucky

Please rush full information on Carrier Natural-Frequency Distribution Conveyors.

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Name_____

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STOP ARCING . . . CORROSION

WITH DOW CORNING

SILICONE COMPOUND

Dow Corning 3 Compound helps eliminate power failures by providing a more durable seal against water, moisture, mine dust, alkalis, acids or corrosive fumes.

Use this grease-like silicone dielectric as a sealing agent in cable connectors and disconnect switches to prevent shorts and arcs. A light coating keeps lamp bulb bases, fuse cartridge clips and battery terminals corrosion-free. 3 Compound protects plastics, rubber, fabrics and metals. It's serviceable from —40 to 400 F.

WRITE TODAY for Free Sample and full information on how you can keep your electrical system at peak efficiency with minimum maintenance. Address Dept. 719.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

The acker

HILLBILLY DIAMOND CORE DRILL

LIGHT—LEAN

Ready to prospect anywhere

Acker's Hillbilly diamond core drill is light and lean without fancy extras or troublesome gadgets. Acker designed this rugged marvel specifically for mineral prospecting.

To save weight and expense it contains only the barest essentials, yet it's completely self-contained with power plant, planetary type drum hoist, welded tubular steel skid frame and when needed, a built-in water pump.

Two tried and proven models available:

Screw Feed weighing 872 lbs.
Hydraulic Feed weighing 1050 lbs.

For complete Hillbilly specifications and information please write for Bulletin 29-EMJ.

ACKER DRILL CO., Inc.

P.O. BOX 830 • SCRANTON, PA.

Full 360° swivel head permits drilling at any angle. The hinged drill head swings out of the way and the powerful drum hoist conveniently lifts or lowers drill rods when adding or removing drill rods.

A drum hoist, with ample fairleads and pulleys for winching the rig into position, makes the Hillbilly "the drill you can take with you!"

Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment

Africa (*Continued*)

were all up on the previous March but blister copper recorded a decline of just over 2,000 tons—15,447 tons as compared with 17,525 tons in the comparable month of last year.

An amendment to the Ethiopian mining law, which was passed in the first quarter of 1958, exempts new mining concessionaires from income tax for 6 years and simplifies administrative channels for granting concessions. The chief difficulty remaining for companies seeking concessions in Ethiopia is that, for rights in Eritrea, it is necessary to negotiate with both the Eritrean and Ethiopian governments.

A deposit of radioactive minerals has been discovered near the Egyptian town of Fayuen.

An official statement classifies the find as "extensive" but judgement on its importance is being withheld until the results of tests carried out by the Cairo University and several other universities outside of Egypt are made known.

IN THE PHILIPPINES

Mindanao Mother Lode Mines is continuing normal operations at its copper mine in Zambales. The milling rate averages about 6300 tpm of 2.5% copper. For this year's first quarter 23,100 tons were milled, with a gross copper value of $229,000. Last year the company produced 4,885,330 lb copper at a cost of 26.2c per lb before depletion. Reserves total 258,000 tons of 2.26% copper, sufficient for 2½ years ore supply at present milling rates. However, there are good geological reasons to expect the ore to continue at depth. Production will be increased to a milling rate of 10,000 tons a month.

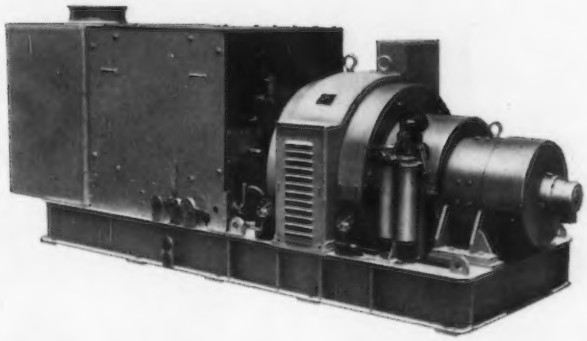
Lepanto Consolidated milled 38,714 tons in June to recover 4237 tons of concentrates estimated to contain 2,386,720 lb copper and 3905 oz gold. Average copper content of the ore was 3.24%, with 0.128 oz gold per ton. During the 10 years since operations were resumed, Lepanto has produced 246,500,000 pounds of copper and 413,600 oz gold.

Atlas Consolidated Mining has succeeded in obtaining a barter contract with a Japanese importer of copper. July production will probably exceed 4-million lb. Mill heads have improved in grade and now exceed 0.7 copper.

IN AUSTRALIA

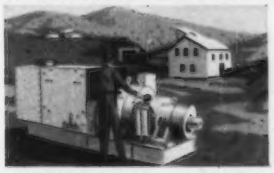
According to Government mineral economists, no sign of any improvement will

Solar's 300-kw gas turbine generator offers 5 unique advantages



① **Compactness, light weight, low-cost installation**
② **Reliable 10-second starts from -65F to 130F**
③ **No vibration, low noise levels**
④ **Low maintenance and operating costs**
⑤ **Ability to burn a wide variety of fuels**

Truck-mounted Solar generators can be easily moved to remote locations.



Reliable, instant power makes these sets ideal for dozens of applications.

POWERED BY A 500 hp Jupiter® gas turbine engine . . . Solar's 300-kw generator set weighs only 6900 pounds and is considerably smaller than the average automobile! Installation is easy . . . and *costs less* . . . because lightweight, vibration-free gas turbine generators require no foundation.

Push-button starting is automatic on Jupiter-powered generators. They require no warm up, reach full power in less than 10 seconds . . . even after long periods of standby service. Simple in design, with few moving parts, the sets require a minimum of maintenance and no operating attendance. And they can be operated efficiently on almost any available fuel—including gasoline, kerosene, diesel fuel, jet fuels and natural or manufactured gas.

Compact, reliable Solar gas turbine generators are ideally suited for mining, missile ground support, industrial and other important applications. For detailed information, write to Dept F-64, Solar Aircraft Company, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY
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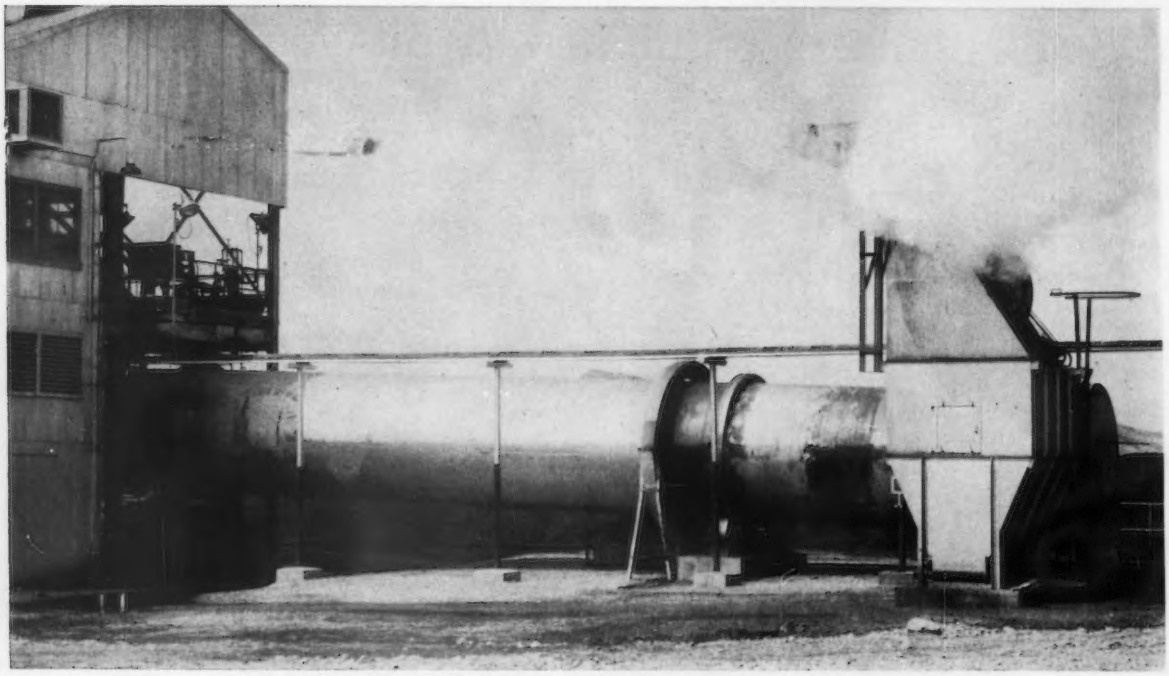
DES MOINES

HELPING OTHERS PRODUCE A BETTER PRODUCT...

STANDARD HERSEY DRYERS



American Gilsonite's STANDARD cooler in operation at Grand Junction, Colorado.

GILSONITE TO GASOLINE... STANDARD STEEL SUPPLIES COKE COOLER FOR FIRST COMMERCIAL PLANT!

Standard Steel Corporation designed and built the rotary coke cooler now in operation at American Gilsonite's new refinery at Grand Junction, Colorado. This refinery, the first of its kind in the country to convert gilsonite into gasoline on a full scale commercial basis, uses an 8 ft. by 80 ft. coke cooler in the process. It's another cooler *Job-Engineered* by Standard Steel Corporation! A specially designed "floating inner jacket" protects the outer shell... and a water cooled feed and chute pre-cools the coke. Here is another fine name added to the long list of prominent, satisfied users of STANDARD STEEL rotary processing equipment.

Designers and Manufacturers of

ROTARY DRYERS
KILNS—COOLERS
CALCINERS
HEAT EXCHANGERS
...AND OTHER PROCESS EQUIPMENT

IF YOU HAVE A PROCESSING PROBLEM!

STANDARD STEEL welcomes the opportunity to discuss with you any problems you may have in drying, cooling or calcining. Our laboratory testing equipment determines beforehand the best equipment for your problem.

STANDARD STEEL CORPORATION

General Offices & Plant, 5060 Boyle Avenue, Los Angeles 58, California

Midwest Offices & Plant **LEADER IRON WORKS** *Decatur 60, Illinois*

(Division of Standard Steel Corporation)

ROTARY DRYERS • KILNS • COOLERS • ASPHALT PLANTS

Australia (*Continued*)

appear in the rutile market during 1958 and first part of 1959. Australian output of rutile is being again curtailed and should equal or even drop below the 1956 level when 96,000 tons were produced. If the situation does not improve in 1959, it is possible that output in that year will drop below the 50,000 ton mark. There is also little prospect of recovery in zircon prices during 1958, again according to Government experts.

High grade uranium ore has been found near Olary, South Australia. Assays are being made and the director, Dept. of Mines, is of the opinion that specimens recovered are among the best ever seen in Australia.

Despite the voluntary 10% cut in working time for the past six months, output of North Broken Hill Ltd. for the year ended June 30 was about the same as in previous year. Throughput during the the year was reduced from 395,042 to 380,096 tons but the grade of ore was higher at 13.7% (12.9) lead, 11.4 (11.0)% zinc and 7.0(6.9) oz silver. Production was 71,289(69,311) tons lead concentrates and 74,041(74,326) tons zinc concentrates. Metal content of the lead concentrates was 50,352(49,245) tons lead and 2,469,018(2,508,497) oz silver, and of the zinc concentrates 37,658(38,035) tons zinc.

Reflecting increased ore throughput and a rise in grade, Mount Morgan's Ltd. gold and copper output rose sharply in the fiscal year ended June 30. Gold production totalled 51,057 oz compared with 37,716 in the previous year and 47,655 oz two years ago. Copper output rose from 5,470 tons to 7,424 tons. The mill treated 875,350 tons of ore compared with 738,300 a year ago.

Higher output from its Risdon and West Coast mines was reported by Electrolytic Zinc Industries Ltd. The figures, which are for the fiscal year ended July 2, show that the Risdon plant produced 115,129 tons of zinc in 53 weeks compared with 106,622 tons for the previous year's 52 weeks. At the West Coast mine, the company treated 210,440 tons of ore (prev. 191,238) for 10,104(9308) tons lead concentrate, 61,672(56,279) tons zinc concentrate and 8,371 (6,000) tons Cu concentrates.

Broken Hill South Ltd.'s output for the year ended June 30 was 51,545(prev. 51,411) tons of lead concentrate and 64,822(64,226) tons of zinc concentrate. For the year the company treated 339,670(332,540) tons of ore averaging 11.7(11.9)% lead, 7.0(7.1) oz silver and 11.3(11.4)% zinc.

In the 12 months to June 30, Great Boulder Gold Mines Ltd. treated 511,859 tons of ore, the first time the half-million mark was passed. Gold recovered totalled 124,392 fine oz; silver 39,408 fine oz and head value of ore was 5.32 dwt. During the period, 14,058 ft of exploratory work was completed of which 29.5% was in payable ore of not less than 4 dwt.

CHEMICALS FOR ORE DRESSING

HOECHST

Collecting agents
Sodium ethyl xanthate
Potassium ethyl xanthate
Sodium isopropyl xanthate
Potassium isopropyl xanthate
Sodium sec. butyl xanthate
Potassium butyl xanthate
Potassium amyl xanthate
Potassium hexyl xanthate
Diethyl and Dihexyl xanthogens
Thiocarbanilide

Collecting / frothing agents
Phosocresol A
Phosocresol B
Phosocresol C

Frothing agents
Flotol A
Flotanol F
Flotigol CS

Cationic collectors
for ore flotation

We offer technical advice on all flotation problems

Zw 60-E

FARBWERKE HOECHST AG. vormals Meister Lucius & Brüning Frankfurt (M)-Hoechst GERMANY

ALLUVIAL DEPOSITS

Gold-Tin-Columbite-Ilmenite-Bauxite Rare Earths

Most accurately and economically tested for . . . with the

EMPIRE DRILL

NEW YORK ENGINEERING COMPANY

75 West St., N. Y. City, U.S.A. Cable Address NYECO, N.Y.

BLAW-KNOX

Blaw-Knox buckets for heavy duty service cut rehandling costs

Whether you are rehandling from barge, car leaching tanks or tailing pond or stockpiling at the mill or smelter, you can improve your rehandling operations with a Blaw-Knox two-line lever arm bucket, of the proper size and weight.

The extra heavy duty clamshells have proven themselves in leading mining operations all over the world.

An experienced Blax-Knox bucket engineer will lend his assistance without obligation. Call him for a review of your rehandling operations.

WRITE TODAY for Bulletin 2254-R-1 which describes Blaw-Knox two-line lever arm buckets.

BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

best way to belay a boulder...

and keep dewatering screens in shape

Skid bars mounted on Hendrick Wedge Slot Screens protect wedge slot profiles from large ore chunks, greatly reducing wear caused by abrasion. That's why Hendrick screens can stand up under the tremendous punishment of heavy-duty mining. The protection given by the skid bars assures you of a better dewatering job and longer screen life. In addition, the C-12 or CH-12 profile bars have thick, parallel head flanges which maintain uniform openings through the life of the screen.

For further information, write to Hendrick today.

Hendrick Manufacturing Company
70 Dundaff Street **Carbondale, Pa.**
Sales Offices in Principal Cities
Perforated Metal • Perforated Metal Screens • Wedge-Slot and Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro-Dehazer • Distillation Column Internals

curtain going up

The Premier Performance
of the all-new
Joy Rotary Percussion Drill

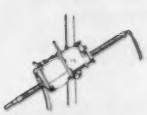
see it working at
outside exhibit
area Booth 736
1958 Mining Show

If you can't get to the show in San Francisco — write Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa., Dept. R.P.D. for complete details.

WSW M 7282-253

Consult a Joy Engineer

JOY . . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY


Core Drills

Slushers

Rock Bits

Drillmobiles

UNDERGROUND
OR ON THE
SURFACE

YOU'LL CUT EXPLORATORY COSTS IN HALF WITH THESE DIAMOND CORE DRILLS

SUPER PIONEER

Here's a rugged compact light-weight drill you can take anywhere. The Super Pioneer eliminates guesswork by giving a true core sample to depths of 100' or more. Designed for one-man operation, drills at any angle in all formations. Gasoline-powered drill and pump weigh just 35 lbs. each.

Basic kit includes drill, pump, and accessories. Rods and bits additional.

$885.00 FOB Spokane

SUPER SCOUT

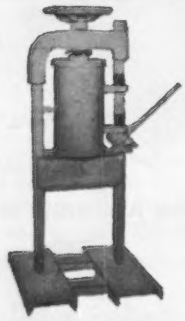
This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!

Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.

$1175.00 FOB Spokane Diamond bits additional

DIAMOND DRILL CONTRACTING CO.
S. 18 STONE ST. SPOKANE, WASH.

Eastern and Southwestern Distributor, SPRAGUE & HENWOOD, Inc., Scranton, Pa., Grand Junction, Colo. • Export Representative, PHILIPS EXPORT CO., 100 E. 42nd St., New York, N. Y. • Western Canada Distributor, AIR POWER Ltd., Vancouver, B. C.



MINIMIZE FILTERING TIME WITH THE BOOTH PRESSURE SAMPLE FILTER

Unlike most pressure sample filters, it does not require the tightening of two screws before applying air pressure, thus making it unexcelled for speed and convenience. It is closed by simply swinging barrel and yoke into place and rotating hand wheel. When open, free access is given to barrel and base. All parts line up automatically. Write today for Bulletin No. 566 giving further information.

—40 YEARS OF ORE TREATMENT—

THE BOOTH CO., INC., 333 WEST 14TH SO., SALT LAKE CITY, UTAH
MINERALS SEPARATION • RESEARCH • EQUIPMENT • PLANT OPERATION

Australia *(Continued)*

The liberalization of a section of the Western Australian Mining Act has led to an unprecedented surge of big capital interest in Western Australia.

Reynolds Pacific Mining, associated with Reynolds Aluminum, has been granted a 4,800 sq miles bauxite prospecting right near Wyndham. Rio Tinto has 13,000 sq miles at Southern Cross to prospect for minerals other than gold and iron while Union Carbide Corp. has lease options near Port Hedland for manganese.

IN LATIN AMERICA

CHILE

Cia. Minera du M' Zaita, which owns mines and mills at El Melon and Cabildo in Central Chile, has been importing milling machinery from France (crushers, rod-mills, flotation cells, etc.) to increase and improve its milling operations at El Cobre and Cabildo.

BRAZIL

The nuclear energy agreement between Brazil and the U.S. has been amended to allow an increased amount of enriched U235 for Brazilian consumption. The agreement originally called for 6 kilograms of U235 to be delivered to the experimental reactor at Sao Paulo.

Under the new agreement, the total amount has been increased to 15 kilograms.

ARGENTINA

The Mining Division of the Argentine Industry Department (Subsecretaría de Minería) announced that Argentine mineral exports during the first six months of 1958 amounted to 26,280 tons, valued at $3,035,021. The respective figures of the previous year were 27,378 tons, and $3,101,917.

Wolfram minerals had an export value of $1,488,088; borates, $307,217; silver, $301,305; and beryllium, $205,918.

IN THE FAR EAST

Peking radio recently said that what might be the "world's biggest copper deposits" have been discovered along the Chiyen mountains in Chinghai province, China.

time will tell...

made hard and tough to the core...for the long grind

The STANDARD OF COMPARISON around the world in grinding balls is Moly-Cop. Time and again, in mills all over the world the long wear of Moly-Cop balls has been the answer to production economies. Next time you order grinding balls — think a minute — then specify Moly-Cop alloyed, forged and heat treated grinding balls by Sheffield.

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ARMCO®

MOLY-COP

TRADE MARK

COPPER-MOLYBDENUM-ALLOY

Grinding Balls

SHEFFIELD DIVISION ARMCO STEEL CORPORATION SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

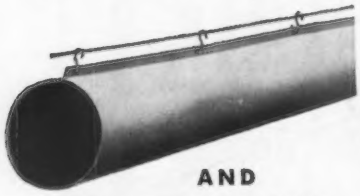
EXPORT REPRESENTATIVES, THE ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

PUSH IN
FRESH AIR

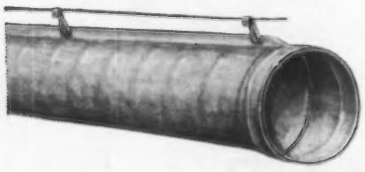
PULL OUT
FOULED AIR

WITH

A B C
NEOLON FLEXIBLE
VENTILATION TUBING



AND
WIRE REINFORCED
NEOLON TUBING



"Push In and Pull Out" ventilation is becoming increasingly popular in mines because of its effectiveness. A B C Tubing of **NEOLON**—the amazing, tough, rip-proof neoprene coated nylon fabric—gives longer service with maximum economy. Regular **NEOLON** Flexible Tubing for blowing in fresh air and Wire Reinforced **NEOLON** Tubing for exhausting fouled air. All standard diameters, in any length. Both types easy to couple and choice of "S" hook or Rivet Hook suspension. A B C Tubing is the most complete line. Send for Catalog 158.

A B C AMERICAN
BRATTICE CLOTH CORP.
220 S. Buffalo St., Warsaw, Indiana

Far East (*Continued*)

The radio also said valuable nickel and other metal deposits have been found in the area.

The Japanese Atomic Fuel Corp. recently began developing extensive uranium ore resources at Ningyo Pass in the Okayama-Tottori prefectural border district, southwestern Honshu Island.

The ore has been named "Ninyo-it" as uranium has never previously been discovered in this type of sedimentary formation.

Bauxite has been discovered in Sematan, Malaya, a remote corner of Sarawak. Two months ago the first ship load of 35,000 tons of bauxite left for Japan and Formosa, for smelting.

This represented only a small fraction of the large bauxite deposits lying in the area in and around Sematan, a Sarawak Government official said.

Exports of Indian iron ore in 1957, (2,262,000 tons) are stated to have exceeded the second Five Year Plan target of 2-million tons.

Japan, Czechoslovakia and Poland continued to be the principal buyers—the quantities exported to these countries being 1,347,040 tons, 476,833 tons and 138,203 tons respectively.

Radio Peking recently announced that the Kwantung copper fields will this year produce 30,000 tons of copper. The largest deposits are located at Shuikwan and on the island of Haiman.

The admission of Soviet Russia to the International Tin Council as an "observer member" was recently strongly opposed by Malayan miners.

Both European and Chinese mining circles will accept Russia only as a full producer member prepared to restrict her tin exports.

The president of the FMS Chamber of Mines, K. J. Cumming said:

"If Russia were to become an observer, I cannot see how producer participants in the International Tin Council would benefit.

"What we want is a decision from Russia at the very earliest as to whether she is prepared to become a producer-participant, which she has been requested to do by the council.

"If Russia were to become an observer she would be in a position to obtain certain information which she may use to further aggravate the position as far as producer-participants are concerned."

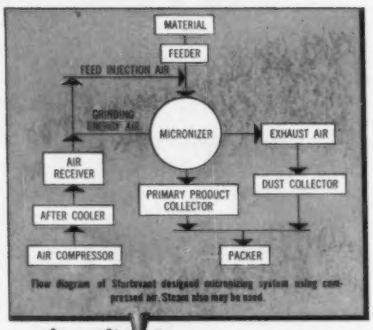
Peking radio recently said that two huge iron ore reserves—one in Kweichow province, southwest China, with an estimated 4.6-billion tons and the other in Hunan province, central China, with 3.0-billion tons (estimated)—have been discovered.

These are among the newest discoveries of iron ore reserves in China this year, the radio said.

Rich iron ore reserves were previously found in Kiangsi, Hupeh, Yunnan and other provinces.

Need ½ to 44 Microns?

Sturtevant Micronizers* Make 325 Mesh Obsolete



Flow diagram of Sturtevant designed micronizing system using compressed air. Steam also may be used.

One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from ½ to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model (15 in. chamber)

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size.

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

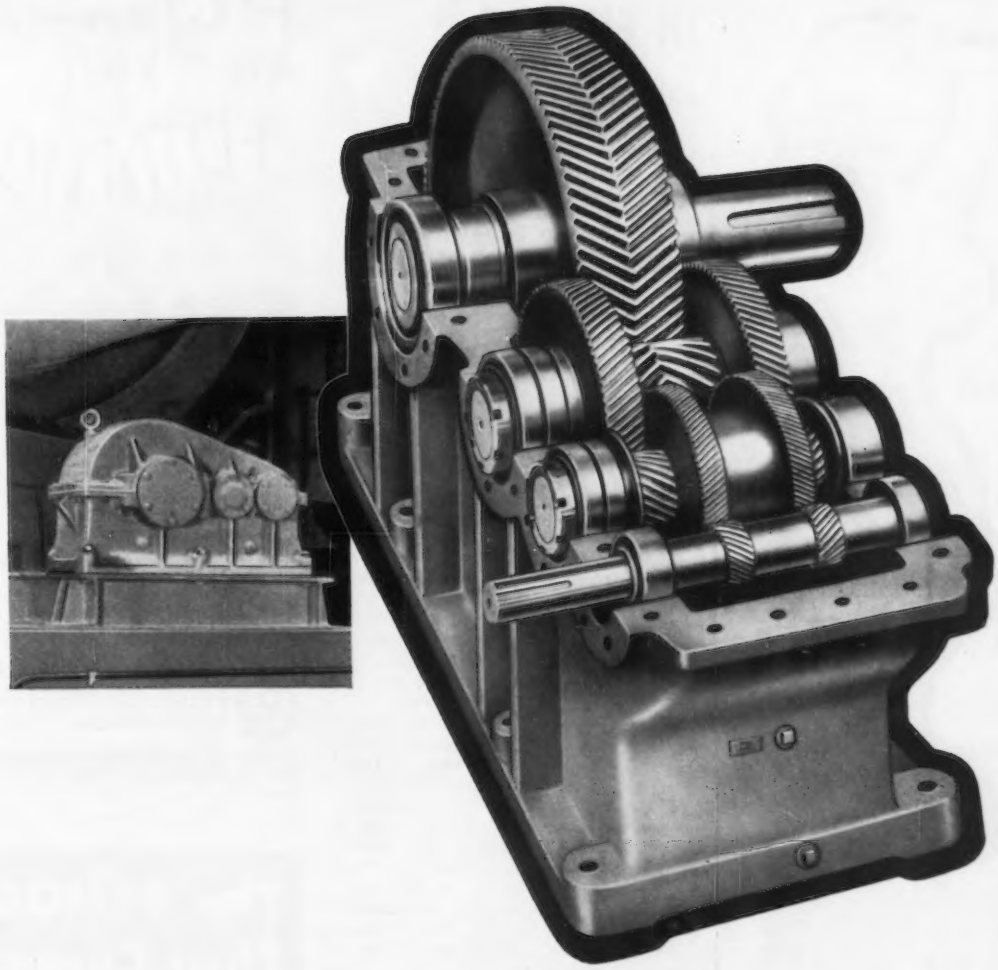
A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 101 Clayton St., Boston, Mass.

*REGISTERED TRADEMARK OF STURTEVANT MILL CO.



THE HEAVIER THE LOAD . . . THE MORE YOU NEED

PHILADELPHIA HERRINGBONE REDUCERS

Heavy repeated shock loads . . . high horsepower . . . round-the-clock operation . . . put them together and you have the kind of a job where Philadelphia Herringbone Reducers perform best. They will last longer and save your maintenance dollars because extra strength is built into every part . . . housings, shafting, bearings and gearing.

To be specific:

Housings are specially reinforced at points of greatest stress. Extra heavy bearings take shocks and heavy overhung loads in stride. Result: shaft alignment is accurate . . . and it stays accurate. Gears, pinions and bearings last longer.

To meet the specific needs of each application, gearing is specially designed and symmetrically arranged in the housing. Result: the bearings on each shaft carry equal loads, shaft deflections are minimized, bearings and gearing have higher shock load capacity.

Pound for pound, horsepower for horsepower and dollar for dollar, you can't buy a herringbone reducer that will outlast a Philadelphia. They are designed with *your* heavy duty drive problems in mind . . . so that you will never have a drive problem.

Philadelphia Herringbone Reducers are available in single, double and triple reduction for ratios of 1.75:1 to 292:1. Write today for your copy of Catalog H-55.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

...Open Pit stripping, of course! Our Mining experience extends over 20 years on large and small contracts. for that brand of performance, we have the men, the equipment, the know-how.

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IN EUROPE

HUNGARY

A precious metals extraction plant is under consideration at Recsk copper mines in central Hungary.

Hungarian News Service claimed that two tons of silver and 448 lb of gold have been extracted from ore originally mined for its copper content since 1956, when construction began.

The extraction plant will be completed by the end of 1959. Precious metals mined in Hungary are handed over to the Hungarian National Bank, the report said.

AUSTRIA

Austria, because of deteriorating world prices, plans to halt wolfram ore mining.

The wolfram mining output decreased from 3,000 metric tons during the first half of the past year to 2,600 metric tons this year. Most other important metal and mineral mining branches reported stabilized output on the whole, with slight increases as the rule.

Iron ore output increased by 2,000 metric tons to 1,685,000 metric tons. Magnesite—by 13.2% to reach 627,000 metric tons. The government's aid measures for the ailing non-ferrous metals business showed positive results, in that a 3.4% increase in lead-zinc ore output (94,500 metric tons) was recorded. The drop in copper ore mining by 300 metric tons is held insignificant, the actual cutput resting at 82,600 metric tons during the first six months of the current year.

Vienna's "Montan Berichte" (July 29, 1958) reports that the Soviets claim to have succeeded in gaining uranium from sea water.

The first successful results were obtained from water of the Pacific Ocean and of the Japanese Sea, writes Montan Berichte, quoting a Tass release.

Scientists at the Oesterreichische Stickstoffwerke A.G., Linz, are working on a method of extracting uranium from rock phosphate imported into Austria.

Tests have shown that one ton of rock phosphate contains from 3½ to 7 oz of metal. Estimated uranium recovery per year is about 10 tons.

USSR

The USSR Academy of Sciences recently held a conference to discuss the development of the production forces of Siberia. Scientists discussed questions concerning the further development of the power industry, the establishment of a single power system in eastern Siberia, and the study of raw material resources (primarily for ferrous and nonferrous metallurgy).

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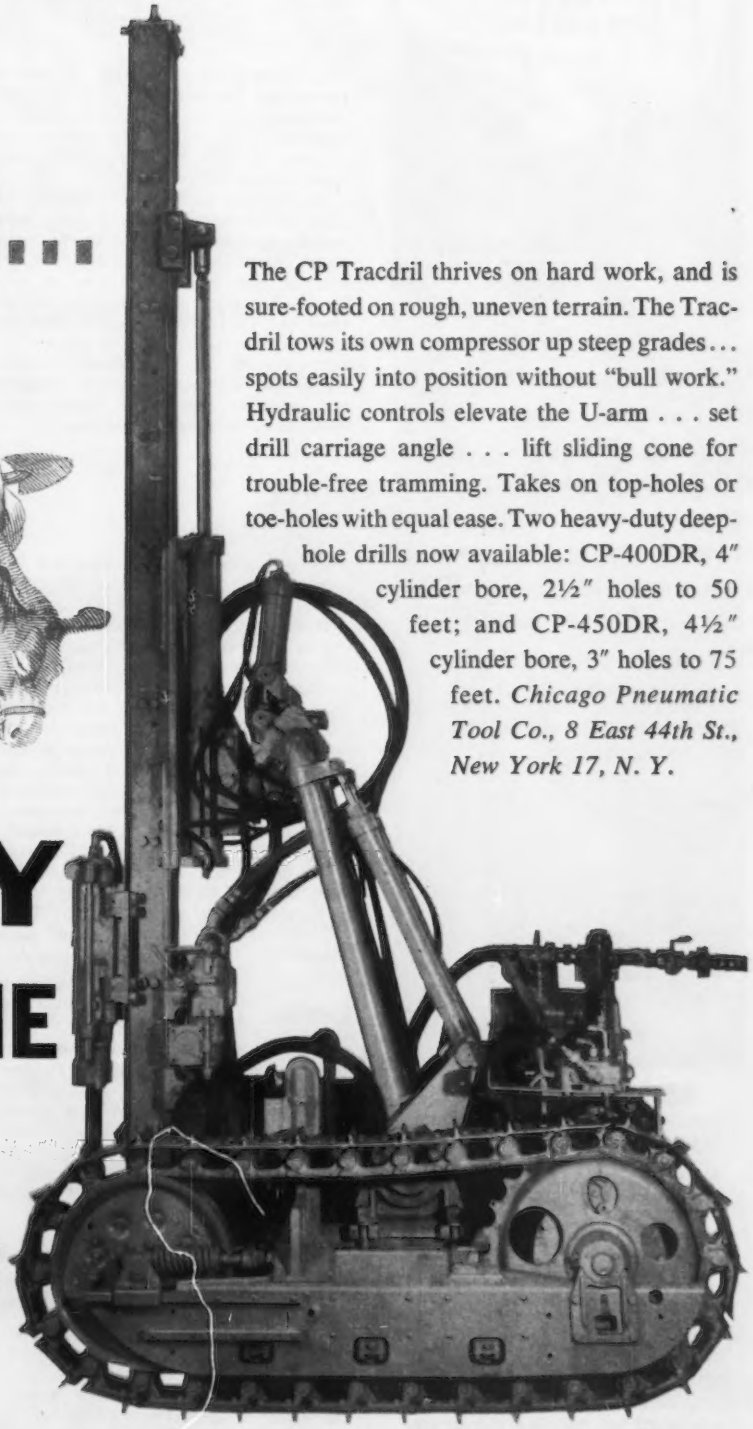

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USSR (*Continued*)

Russia has started mass producing methane detectors for installation in all Soviet coal mines, the Russian newspaper, Soviet News, reports.

Designer of the detector, Alexander Shcherban, is now experimenting with a carbon monoxide detector, the newspaper added.

In a recent interview with the Soviet newspaper "Isvestia", Minister of Mines Antropow asserted that Russian mineral resources are presently extensive enough to meet the country's needs for many years ahead.

Recent major finds by Soviet geologists and prospectors, the minister said, include an iron-ore deposit in the vicinity of Nowo-Oskol in the Belgorod district (at least 300-million tons of ore). In the Ukraine, large deposits of sulphur and fluorite have been discovered, and enormous quantities of copper and nickel-bearing ores are available for mining in the Murmansk district. Valuable and extensive deposits of bauxite have been unearthed in Kasachstan.

ITALY

Although production of mercury has continued to rise, exports have decreased considerably.

During the first five months of the current year mercury production reached 895 tons compared to 867 tons for the corresponding period of 1957, a 3.2% increase. However, exports for the same period shrank from 681 tons to 153 tons. This appears even more serious if the 1080 tons exported during the first five months of 1956 are considered. Values of exports for the five-month period of 1956, 1957 and 1958 amounted to $8-million, $5-million and $1-million.

Ore production was 137,000 tons for the five-month period of 1958, 12% less than in the same period of 1957 when 156,000 tons of quicksilver ore were produced.

Letters (*from p. 99*)

It is not the intention of this letter to go into precise details for the purpose of refuting the arguments of Mr. Deringer, but we must reject his imputations. We can sympathize with his bitter feeling, but cannot condone his conclusions.

Engineering Staff
Corporacion Minera de Bolivia
Empresa Minera Catavi

(The following letter from Empresa Minera Catavi's geologist, discusses some of the suggestions made by Mr. Deringer.

Reference is made to Mr. Deringer's suggested selective mining of contact-metamorphic rocks.

In the first instance, there is a very low degree of contact-metamorphism on the rocks. This opinion is held by Ahlfeld[1] and Turneaure[2].

Maybe Mr. Deringer means hydrothermal-metamorphism, a series of processes that played a principal role in the Salvadora intrusion.

The most important rock types resulting from the hydrothermal-metamorphism are[3]:

(a) *Sericitized porphyry,* independent of mineralizing channels. This process affected the whole rock mass.
(b) *Tourmalinized porphyry* or "black porphyry" forms irregular masses independent of the veins.
(c) *Silicified porphyry* occurs locally as a narrow band along the veins.

The specific gravities of those rock types show certain differences; however, to mine those irregular zones separately would involve a reorganization of the mine which is not justified for the following reasons:

The components of the mine output are: (1) solid veins, (2) old gob fills, (3) dumps, and (4) block-caving.

Selective mining is possible for the solid veins only, but that is no more than 13.5% of the total production. The rest is mixed material, in which all the above cited rocks occur.

Selective mining on a petrological base as proposed by Mr. Deringer is a theoretical suggestion without practical value.

Cornelis Bloot

[1] Ahfeld: *The Tin Ores of Uncia—Llallagua.* Ec. Geol. 1931, p 244
[2] Turneaure: *The Tin Deposits of Llallagua.* Ec. Geol. 1935, p 17
[3] Turneaure: *The Tin Deposits of Llallagua.* Ec. Geol. 1935, p 34

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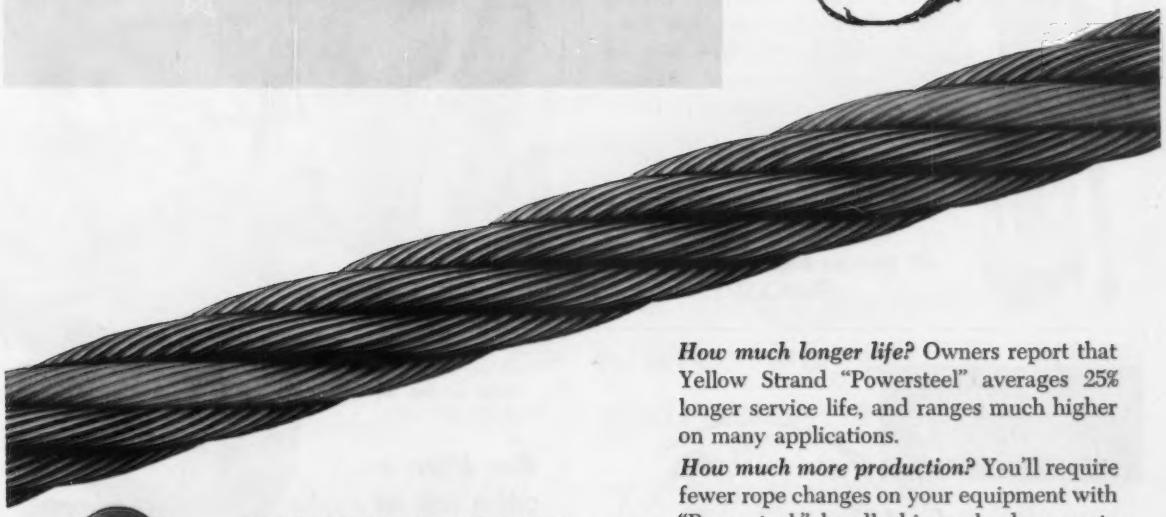

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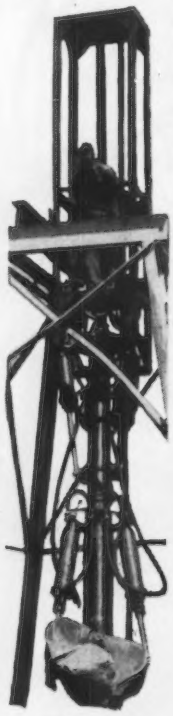

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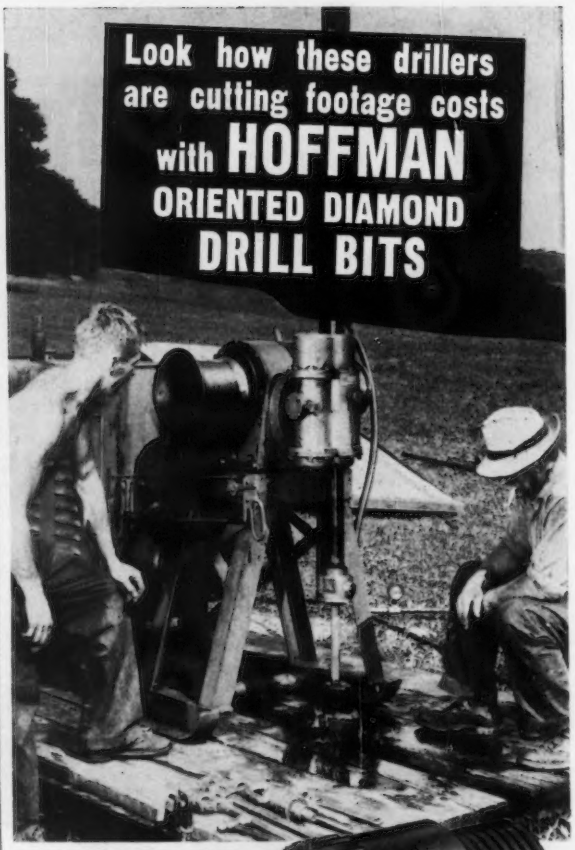

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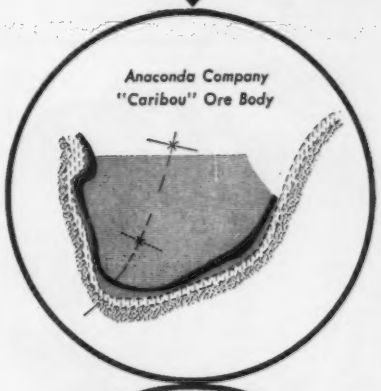

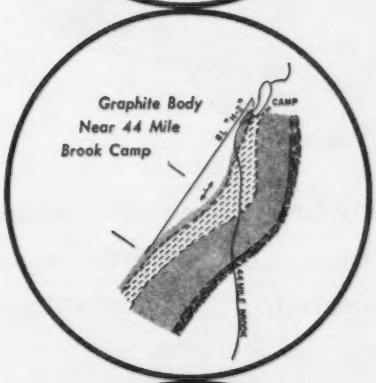

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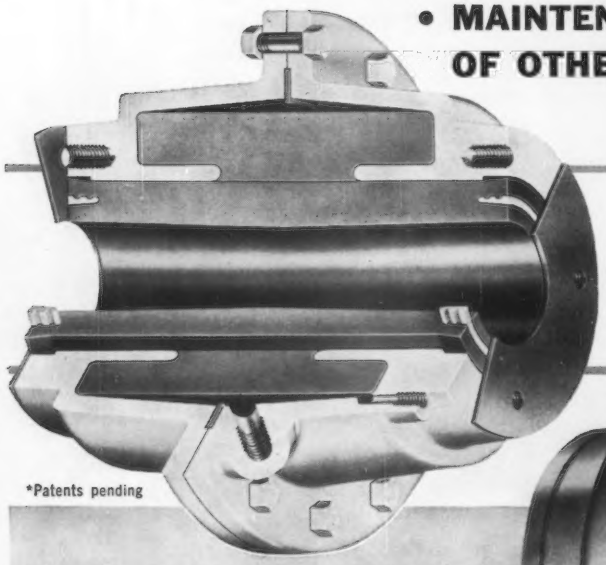

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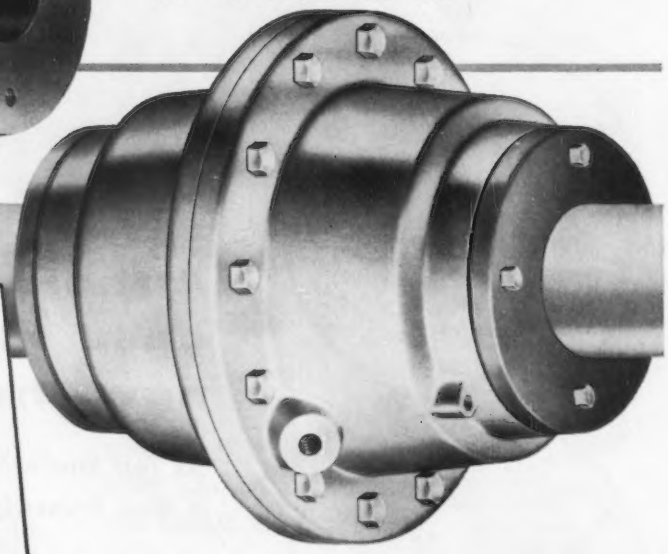

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2—6 ton General Electric Locomotives
2—7 ton General Electric Locomotives
1—7 ton Atlas Locomotive
3—8 ton Ironton Locomotives
2—8 ton Goodman Locomotives
2—8 ton General Electric Locomotives
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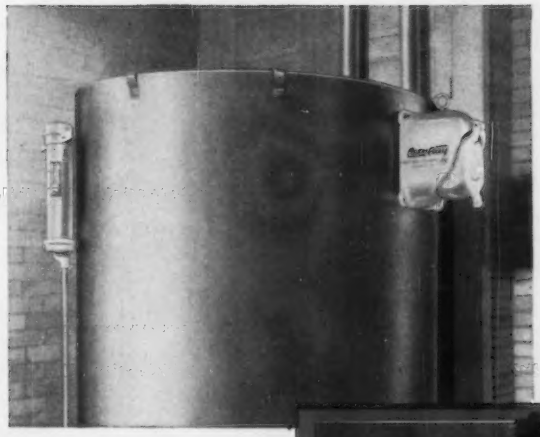
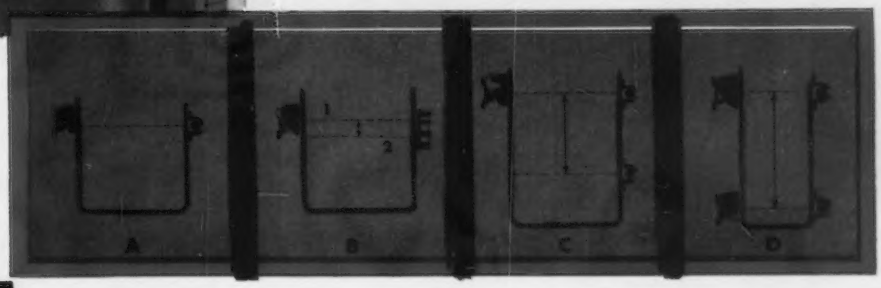


Adaptable to four methods of operation, AccuRay's Detector-Controller offers outstanding advantages over float-level type control systems. It is easily installed and maintained and is priced from only $465.00. The Detector-Controller utilizes two units—a radiation source housing, which provides more than adequate shielding, and a detector. Both units are mounted externally . . . thus are free from fouling by process materials. Accuracies can be maintained to ± 1/8" as a high or low level alarm. The source housing can be pivoted to provide radiation shielding during work inside the tank. Design of the instrument is in accordance with accepted standards for both explosion-proof and weatherproof operations.



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A High or Low Level Control . . . The detector is mounted diametrically opposite the radiation source. When the material moves above the level of the detector, the radiation is cut off, causing the output relay to change position. When the material drops below the level, the output relay is thrown to its opposite position. **B** Narrow Band Control . . . The detector is mounted vertically along the tank, resulting in narrow band control. When the material moves above position (1), a signal is provided from the output relay. The opposite signal is provided when the material drops below level (2). **C** Wide Band Control . . . A single source unit is teamed with two detector elements. The material can be controlled within the distance separating the high and low level detectors. The signal can also be used to provide a combination high-low level alarm system. **D** Extra-Wide Band Control . . . Two source units are teamed with two detectors in cases where the vertical separation desired is large relative to the tank diameter. This system can also provide a high or low level alarm.

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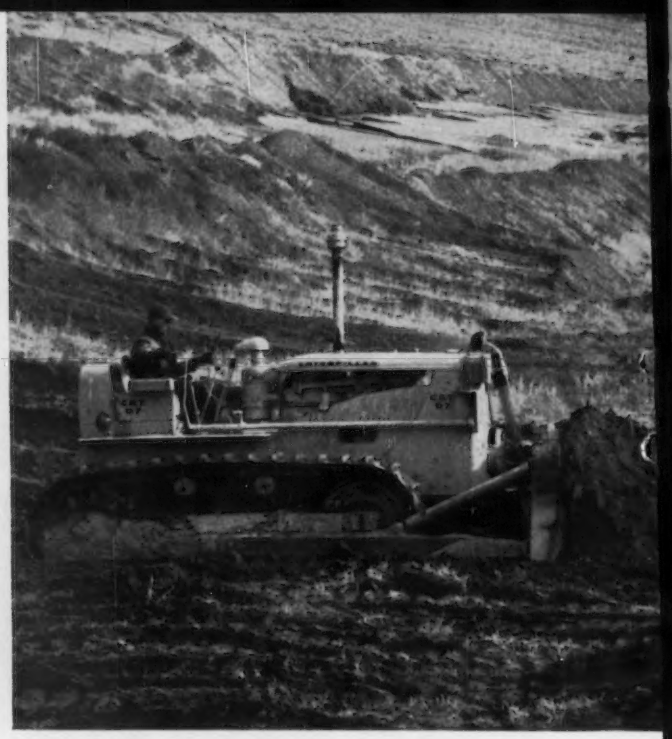
Q: WHICH D7 IS THE OLD-TIMER?

This Cat D7 Tractor with No. 7S Bulldozer feeds the grizzly about 450 tons of gold ore a day.



This Cat D7 Tractor with No. 7S Bulldozer, working in heavy wet sand, is building a 2-mile-long dike.

A: If you know your Cat Diesel Tractors, you've spotted it on the left. It's 12 years old. With the new D7 and a D8, it's used by the London Extension Mining Co. in an open pit mining operation 30 miles from Beowave, Nevada. The climate's rugged. Temperatures range from –20° to 110°.

Q: What does the company think of the machines?

A: It has had Caterpillar-built equipment since 1936. General Superintendent R. B. Warmbrodt says: "We find the tractors are rugged and stand up well."

Q: How are the machines used?

A: Generally one is kept in the pit cleaning up around shovels, while the other feeds the grizzly 450 tons of ore a day. The machines also strip overburden, handle tailings and knock down dump piles from trucks at the stockpile. Two months a year, the new D7 builds about 2 miles of dike to control tailings. The machines are on duty 7 days a week all year 'round.

Q: How do the D7s compare in production?

A: Good as the old D7 is, it's not in the same league with the modern, heavy-duty D7. Of course, that's to be expected. Caterpillar constantly builds improvements into its machines. The new D7 is more powerful, easier to operate and more rugged. For example, among many modern features, it has the oil clutch that delivers 1,500 hours without adjustment.

Q: Has the company any other Caterpillar equipment?

A: Yes. Two engines in shovels and two in compressors. Mr. Warmbrodt says: "Since we're far from supply, we find the parts interchangeability of Caterpillar units a decided advantage. We also get excellent service from our Caterpillar Dealer!"

Add all this up and you get some of many reasons why it will pay you to use a Cat Diesel Tractor on your operation. You can't beat the combination of rugged machines, parts availability and good dealer service. Ask your Caterpillar Dealer to give you the low-down on the new D7's high productive capacity. Better still, watch one work —ask him to demonstrate on your job!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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FOR DEPENDABLE PRODUCTION USE RUGGED CAT DIESEL TRACTORS

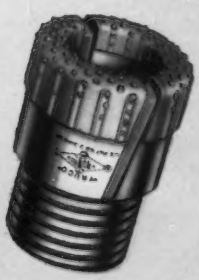
HIGH salvage–a built-in "extra" in every Truco Bit

The scoop of diamonds in the foreground represents one of the important sources of savings when you use Truco Bits—salvage, *high* salvage.

High salvage had its first beginning many years ago when Truco engineers developed the remarkable matrix metal in which Truco diamonds are held in a chemical as well as physical bond. The tenacity of this bond greatly reduced diamond loss, kept more diamonds cutting longer and deeper and yielded more salvage.

Getting the salvable diamonds out of this matrix without damaging them was the next problem and it was solved by Truco engineers developing a process in which the matrix metal is dispersed by electro-chemical action and the diamonds are released. When perfected, this process was adopted by the entire industry.

Above, right: a new three-inch bit ready for use. Center: a bank of salvage tanks in which used bits are being processed. Below, left: a used three-inch bit after the salvage process and salvaged diamonds which will be reset "best face to the work" as always in Truco Bits. Thus, through high salvage and expert resetting, the diamonds in your Truco Bits give you additional footage and additional economies which can be an important factor in reducing your operating costs. Try a Truco and see for yourself.



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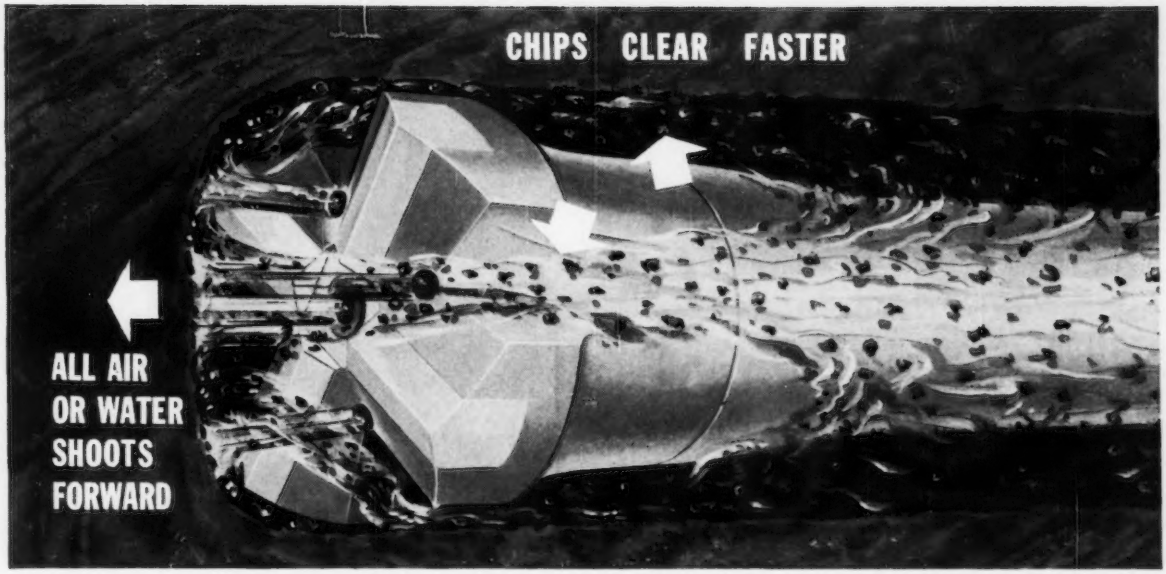

How new TIMKEN® threaded bit cuts drilling costs on drifters, sinkers and stopers

SPEED DRILLING and cut bit costs with these new Timken threaded bit features. 1) New five front holes and 2) wider wing clearance speed chip removal; and 3) new wear-resistant carbides give longer bit life.

The action picture above shows how you can cut drilling costs on drifters, sinkers and stopers. The new Timken® threaded carbide bit drills more hole-per-bit because two new features clear chips faster. 1) Newly-positioned five front holes shoot air or water *directly* against the rock face; and 2) deeper, wider wing clearance lets chips wash back faster. Deeper relief under the heel provides an even freer passage. As a result, the bit spends less time "drilling" chips, more time drilling rock. And removing chips this faster, more economical way eliminates the problem of clogged drill steels, prevents damage to bit skirts.

What's more, the new Timken threaded bit has new special analysis carbides that give increased resistance to wear and shock. They can be reconditioned many times. And improved thread contact reduces breakage to a minimum.

To get more hole-per-bit, use the new Timken threaded carbide bit. For more cost-saving details, send for free brochure. The Timken Roller Bearing Company, Rock Bit Div., Canton 6, Ohio. Cable: "TIMROSCO".

USE THESE TIMKEN BITS FOR OTHER TOUGH DRILLING JOBS

IMPROVED TIMKEN ALL-STEEL MULTI-USE BIT

With correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel are used.

THE AIR-LEG BIT OF THE FUTURE

New Timken tapered socket bit is removable for full steel life yet tapered for one-piece strength. Same frontal features as threaded bit.

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